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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and technique may flow to and from every worker in the field of forest fire control.

Volume 6 Number 1

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FIRE CONTROL

FIRE CONTROL NOTES is issued quarterly by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., 15 cents a copy, or by subscription at the rate of 50 cents per year. Postage stamps will not be accepted in payment.

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire-fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

Address DIVISION OF FIRE CONTROL
Forest Service, Washington, D. C.

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Contents

EMERGENCY FIRE PLAN FOR THE EASTERN SHORE OF MARYLAND

(A suggestion for national defense planning)

S. H. Marsh

Eastern Region, Forest Service

After the blow-up of April 20–24, 1941, there was a review of some of the larger fires in Region 7 by the Division of State and Private Forestry to find out what made the big fires big and ascertain what might have been done that was not done to prevent them or confine them to smaller areas.

A review of a fire on the Eastern Shore of Maryland that burned about 2,400 acres, including about ⅔ of the Allegheny Experiment Station's forest of 900 acres, proved most interesting and instructive and led to the formulation of a plan to prevent sweeping fires that may be applicable to extensive areas along the Atlantic Seaboard and perhaps some other parts of this and other regions.

In tracing the course of the fire on an aerial photo, it was noted that after burning some 1,200 acres in an area surrounded for the most part by impassable barriers, it swept through a narrow strip of woods about ¼ of a mile wide into another timbered area where it ravaged 1,200 acres more before it finally was brought under control by the aid of a shower. This vivid indication of a lost opportunity led to speculation as to what would have been necessary in manpower and equipment to keep the fire from using this avenue of escape from one area to another and what might be done by advance planning to prevent similar occurrences in the future.

The photographic index, the only aerial map available, was then studied more carefully. Although a casual glance discloses only a mixed pattern of farm, swamp, and forest land, a closer examination shows that the area breaks down into numerous large bodies of forest land, for the most part insulated against each other by areas of cultivated land, swamps, or rivers, that form absolute barriers beyond which a forest fire could not go if it were permitted to run its course unimpeded. There are breaks or gaps in these barriers that will have to be plugged if they are to hold a fire, but roughly 95 to 99 percent of the barrier is there, waiting to be used. A case study was then made of the Delmarva Protection Unit of the Eastern Shore District to determine the location and extent of these divisions, the degree of insulation, and what can be done to plug such gaps as occur in the existing barriers.

Where a choice in barriers was possible as was often the case, preference was given to areas of open land traversed by roads, in order to make the gaps more accessible to the heavy equipment such as is commonly used by the volunteer fire departments on the Eastern Shore.

After roughing out the larger natural divisions of the Delmarva unit, the photos were studied to determine if these divisions could be further broken down into blocks likewise surrounded by good if not impassable barriers. Again this was found to be possible, although more gaps per mile of line were encountered than in the larger divisions. In the block as in the division lines, the boundaries were drawn to take advantage insofar as possible of barriers traversed by roads.

A field check then was made to determine (1) the adequacy of the barriers selected and in some cases ascertain which of two tentative barriers most nearly approached the absolute, (2) the character of the gaps in the barrier and possibilities of defending them, (3) the amount and kind of equipment required, (4) the manpower needed to do the job, and (5) improvements, i. e., fire-hazard reduction along roads, waterholes, etc., required to make the lines tenable.

Strategy then was taken into consideration bearing in mind that manpower probably will not be as abundant as in years past and the necessity of conserving and stretching it as far as possible and likewise taking advantage of all fire-fighting facilities available.

The general procedure decided upon is, briefly, as follows:

1. When a fire is reported in a certain block, dispatch one or more crews to the fire, with instructions to hit it on the nose or flank it into a barrier, whichever procedure promises to hold it to the smaller area. Simultaneously dispatch volunteer fire departments with equipment previously decided upon to prearranged stations in the gaps on the lee side of the fire, so that if it goes wild it cannot get through into another block. Should it run through a block line in spite of the gap tenders, then they will drop back to the next block line between them and the division boundary or to the division boundary itself, beyond which it cannot pass (unless there has been some very faulty planning).

District Forester Rothrock, of the Eastern Shore, is investigating the possibility of using the aerial photographs in the tower and the dispatcher's office, instead of a map. From the mosaic, strategy can be determined at a glance and dispatching, at least in the initial stages, can be simplified to the extent that it can be done by a clerk who is totally unfamiliar with the ground.

To insure that the initial action on a fire is simplified so that it becomes almost automatic, a form for each division and block was prepared which shows along with other pertinent data of value in prevention action to be taken and by whom, and with what equipment. When completed, these forms comprise the suppression chapter of the fire plan.

With the use of the photographs dependence upon towers to report progress and help mold strategy which at best they can only guess at, will be greatly reduced. The good old custom of hitting a fire on the nose would be abrogated in any instance where less acreage would be lost by running the fire into a barrier by an attack on the flank, and incidentally, considerable amounts of money likewise might be saved thereby.

In short, the operation of this plan will:

1. Simplify and expedite dispatching by making it automatic, at least in the initial stages.

2. Reduce burned area by hastening and facilitating dispatching.

3. Save suppression money by preventing the milling and loss of time resulting from faulty planning and lack of adequate supervision.

4. Eliminate a lot of alibis that superiors are asked to believe about the strange and weird behavior of forest fires.

5. Provide for the maximum use of cooperating volunteer fire departments and their heavy equipment and result in assignment to them of jobs they and their equipment are best prepared to handle, thereby making full use of equipment not ordinarily available for forest-fire control.

6. Encourage the warden and his crew since they will know that all foreseeable contingencies have been provided for and that they are backed up at the gaps if the attack on the nose or flank proves futile.

The plan presupposes some very definite advance planning, but the consolation of knowing when bad fire comes along that the prescription for it is in the bag, should be ample inducement to do a little planning.

While labeled "emergency plan" the blocks may also be subdivided as desired to meet the normal conditions. The forms give much of the information needed to work up a prevention program, which is basic to any fire-control program.

It appears to have a very definite place in national-defense planning since a definite and comprehensive plan can be worked out quickly from aerial photographs and the amount and kind of equipment and manpower available can be easily and quickly checked against the jobs to be done. Likewise it will give point to CCC fire-control planning since the kind and location of projects needed will be definitely known.

Volunteer fire departments have a variety of equipment ranging from light forest-fire trucks in a few cases to heavy and expensive trucks that cannot be expected to operate off of hard roads. The heavy equipment which ordinarily is useless in the woods can be assigned to watch the gaps on a hard road, thus opening up a new source of equipment that in the past has not been available.

Reports are current in many States that the draft and the numerous defense agencies are drawing upon manpower to such an extent that by the fall of 1941 there will be a serious shortage in fire fighters. Many States have reported that this shortage was becoming evident in the spring of 1941 and that in some cases it was even impossible to keep the towers manned with experienced observers. Unless such labor and equipment as may be available is used in a planwise fashion, and in the most economical way, the shortage may become critical.

WHAT'S WRONG WITH FIRE PREVENTION?

H. J. Turney

District Ranger, Prescott National Forest

Since the early days the Forest Service has carried on an intensive fire-prevention campaign. It has been effective. In Prescott, for example, when National Fire Prevention Week comes around most of the people think of forest-fire prevention rather than of preventing fires in their homes. School children make up posters and all of these are on forest-fire prevention. The merchants always ask for our fire signs for window displays. In talking to the public, both people living on or near a national forest and those from a distance, the subject of forest fires always enters into the conversation. People generally have the impression that all a ranger does is fight fires. In view of such evidence there is no doubt that the general public is fire conscious.

Yet, there continue to be man-caused fires. The surprising thing is that most of them are started by local people—people to whom fire prevention has been preached for years.

In 1939 a picnic fire which had been put out to the best of the picnickers' knowledge started a forest fire. The needles had been scraped away and the fire had been built in the cleared place. Before leaving, the picnickers carried clean sand from a wash 50 feet away, and the fire was carefully covered. Yet this fire crept out because the duff had not been removed when the place was cleared for the fire. In 1940, another picnic fire got away under very similar circumstances.

The evidence on both those fires showed clearly that the parties responsible had done everything they knew how to do to prevent starting a fire. The action, however, showed a lack of complete knowledge of what to do or just what was inflammable material.

Those fires made me wonder whether the general public knew how to prevent fires. Last June, I put in a window exhibit in which "WHAT TO DO TO PREVENT STARTING A FOREST FIRE" was stressed. The reaction of the public was good and numerous favorable comments were heard. Those of a young doctor who was reared in Prescott summed them all up. He said, "I've heard all my life to prevent forest fires but this is the first time I've been shown what to do."

That incident suggests that our prevention campaign had made the public fire conscious but has failed to educate them in just what to do to prevent fires. The campaign can be compared to a four-step training project in which the first step has been taken and a desire has been created to prevent fires. And then the other three steps have

been almost forgotten. The only definite information which has been given out is "The Six Rules to Prevent Forest Fires" and these only occasionally in prevention literature. Never in an address, newspaper article, or other prevention material which reaches the general public, have I seen or heard definite information on what to do to prevent starting a fire.

I am reminded of the first time I was on a national forest. I was on my way by horse to take a fire-guard job. After I entered the forest, the trail I was following had a fire sign almost every mile and I read all of them. I kept on smoking as I rode along and it was only through the grace of God that I didn't set the woods on fire. There were many "PREVENT FOREST FIRES" signs, but nothing telling me how to prevent them.

I believe that if all field men would stress "what to do" in their contacts with the public a lot of fires would be prevented. One of my lookouts, who has a number of visitors to his tower, told me of his experience which may be helpful to others. He said, "If I bring fire prevention up first, a visitor seldom says anything, but if I let him bring it up first, I can discuss it with him and get a lot across because we're talking about the other fellow." So much for the approach. But even if field men do all they can, it is physically impossible on a heavily used district for the ranger and his guards to contact every visitor.

Would it not be more helpful if those making radio talks and other addresses or preparing written articles for publications stated just what to do to prevent starting forest fires instead of just using the over-worked statement "Prevent Forest Fires."

Couldn't posters be made to illustrate the following:

1. How to build a safe fire and how to put it out.
2. That tobacco should be thrown on bare ground and stepped on to be extinguished.
3. How to break a match in two, with notation to the effect, "You may burn your fingers the first time you try this, but that is better than setting the forest on fire." ("Break your match in two" doesn't mean anything unless the trainee does some thinking.)

Most fires are not started through willful carelessness. If the public can be educated in how to prevent starting fires, when they see "PREVENT FOREST FIRES" they will know what it means.

The first step has been taken very effectively. Let's take the other three.

FIRE PREVENTION IN THE EASTERN REGION "HOT SPOT"

George B. P. Mullin

District Ranger, Jefferson National Forest, Eastern Region

The Clinch District of the Jefferson National Forest is in the "hot spot" of the eastern region of the United States. Comprising 6 million acres this problem area lies in southwest Virginia, eastern Kentucky, and southern West Virginia.

In 1936, the first land for national-forest purposes was acquired, on the Clinch Ranger District, in the soft coal area. The population of native rural dwellers is dense. The year of 1936 marked a season of heavy fire damage in the area. Prior to the 1937 fire season, an intensive campaign was carried on in which an earnest attempt was made to contact and catalog each family outside incorporated towns. To the local residents were explained the benefits of protecting the natural resources of timber, wildlife, and water from destructive action of forest fires.

The response in 1937 was remarkable, even considering that it was a year of relatively low fire danger. In 1938, the prevention contacts were made again and, in the meantime, the ranger enforced the requirement for campfire and berry-picking permits. In 1938, the respect for fire prevention was noticeably less evident. The number of fires on the Clinch District was on the increase. In 1939, the Clinch District, with about 18 percent of the total area within the protection boundary of the forest, had 33 percent of the fires. In 1940, Wise County, with 5 percent of the area of national-forest land, had 18 percent of the fires on the national forest. The evidence was sufficient to prove that fire-prevention efforts through moving picture showings, personal contacts, press releases, and a vigorous enforcement of the State and Federal fire laws were inadequate to produce acceptable fire-occurrence standards.

As a result of the Elkins, West Virginia, fire-prevention conference, in August 1940 the Jefferson National Forest was assigned the experiment of trying out an adaptation of the fire-prevention school contests successfully staged by Supervisor Conarro of the Mississippi National Forest in Louisiana. The western third of Wise County, with 16 rural grade schools having approximately 2,000 pupils in attendance, was selected as an experimental area. The area consists largely of privately-owned land and small farms up to the edge of the forested area. The population of this area contributed to the fire problem within the national-forest protection area, and it was considered that the number of schools to be contacted would make a full-time job for one man for the duration of the program.

The assistance and cooperation of the County Superintendent of Schools were secured in conducting four periods of instruction in each of the 16 schools on preventing smoker, camper, and brush-

burner fires and in making contacts to get fire-prevention pledges signed. The objective was to instruct each pupil *how* to prevent such fires, so that he in turn would be able to teach adults how to smoke safely and to burn brush without causing a forest fire.

The forest guard assigned to the job was a local man experienced in fire-prevention work, a good instructor, who had the ability to get people to cooperate. Three to four schools per day were instructed until each had received four ¾-hour periods of instruction. He drew upon his own experience to illustrate the destructiveness of forest fires. He told of young birds perishing in their nests, of baby squirrels being killed by the cruel flames, and showed how stupid and uncalled for most such fires are.

Pledges similar to the one shown, which lists a set of simple precautionary measures necessary to avoid smoker, camper, and brush-burner fires, were prepared. During the first two weeks of March the children contacted people in their school areas and brought in as many signed pledges as they could obtain. The section of the pledge which listed the prevention rules was left with the signer, and the stub with his signature was retained for counting. A value of five points was assigned to camper and smoker pledges and ten points to brush-burner pledges.

BRUSH-BURNER PLEDGE

Date__________, 1941
Signed__________
Pledge taken by:
Name__________
School__________

PLEDGE

I promise to observe the following rules while burning brush:

1. I will notify the nearest fire warden or lookout before starting a fire.
2. I will not burn before 4:00 p. m.
3. I will have sufficient help and tools to control any fire started.
4. I will rake a fire line around the area to be burned.
5. I will not leave fire until it is out.
6. I will burn in small piles and begin burning at the top of the hill.

Date__________________ Signed__________________
Pledge taken by______________ School____________

The final score of each school was based on the number and value of pledges obtained and the average attendance of the school during that period. A deduction of 25 points was made from the score of any school if a camper, smoker, or brush-burner fire occurred in the school area between March 15 and April 30 if the person causing the fire had not been contacted by a pupil.

Prizes were subscribed from local civic clubs, fish and game clubs, and coal operators in the area. Contributions of materials and stories carried by local newspapers also helped to build widespread interest in the program. The prizes were as follows: First prize $25 cash, an American flag, and a 40-foot flagpole; second prize $15 cash and an American flag; third prize $10 cash. A framed certificate signed

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by the superintendent of schools, the State forester, and the forest supervisor was presented to each school in the contest. Exercises for the presentation of prizes were held at the three prize-winning schools, with participation by members of the State forester's staff, the board of education and the forest supervisor's staff.

Eleven thousand pledges were signed during the 2-week period, an average of five and one-half per pupil. The total number of fires in the area, including both State and national-forest fires, was 57 in 1941 compared with 58 during the spring fire season of 1940. The percentage of national-forest fires in Wise County dropped from 18 in 1940 to 13½ during the first half of 1941.

It is too early to evaluate the permanence of this prevention effort. Some incidental subsequent check-ups have indicated that the boys and girls retained the *how* of preventing fires. This was a community project; it was the school children'se plan for saving the forests from injury. Unmistakably, the boys and girls penetrated the inner consciousness of their elders, for there was much evidence that the pledges were taken seriously by those signing them.

Although some time will be required to judge the full effectiveness of our prevention program, it is apparent that the procedure outlined is effective in getting people to substitute new habits of carefulness for old habits of careless indifference. These questions arise: How long will thoughtful considration survive old habits and inertia? When should the performance be repeated? How many times must it be repeated to get satisfactory permanent results?

The school prevention program furnished a gage of the effectiveness of the former prevention work. In a school prevention contest conducted on the Holston District, in an area which had been under administration many years and in which it was thought that local sentiment was in favor of fire prevention, many adults refused to sign any pledge of cooperation. Actually, exterior evidence was deceiving, and there was a deep undercurrent of antagonism to fire prevention. Apparently, these individuals went along because the ranger seemed to be a pretty good sort of fellow. Only the exceptional available employee has real ability as an instructor. Our experience to date, indicates that lesson plans must be carefully prepared. Interest and effectiveness could be stepped up through the use of Kodachrome slides. These might, for example, show in several steps how to make and extinguish a campfire safely. The lesson plans in this way could be made almost foolproof. Projection equipment using a wet storage battery is available. A school program such as ours, covering a relatively small area, requires 6 weeks' full time of one man. This is a relatively heavy burden on a ranger district, especially since part of the time, at least, is in the busy fire season.

Figured on the basis of the cost of each contact, the program was a great success; that is, 11,000 personal contacts were made by the efforts of one man in 6 weeks.

The amount of ceremony and flag raising, and this also goes for the cost of the prizes, should be held to a minimum. In the Wise County contests the prizes were probably too costly and the awarding of certificates to each school was also relatively expensive and not entirely necessary.

AN INTENSIFIED FIRE-PREVENTION PROGRAM

A. B. Larson,

Fire Prevention Specialist, Angeles National Forest, California Region

Many persons who feel that the phrase "fire prevention" has been so overworked as to have lost its appeal to the public will find a new approach to those who use the forests in the plan outlined herein. The programs discussed in this article illustrate accomplishments which can be obtained by a full-time prevention specialist working in cooperation with several local organizations.

New ways of accomplishing an old objective—fire prevention—were tried in the 1941 fire season of Angeles National Forest.

It is much too early to boast of the results, but there seems to be little doubt that a far greater number of Southern Californians have had their attention focused on the problem of forest protection than ever before.

The campaign received its initial impetus from the Southern California Conservation Association, and that organization's backing has been an important factor throughout.

The following outline presents the varius phases of the Angeles effort:

Conventional Methods.—During the week preceding Labor Day the editorial cooperation of Los Angeles' metropolitan papers was solicited and 100 percent response resulted. Likewise, many of the newspapers in the county's smaller cities gave similar support. Two Los Angeles papers carried effective cartoons dealing with forest-fire prevention. It may be said in this connection that editorials probably do not reach the persons most likely to be careless with fire, but nonetheless such aid is valuable in that it appeals to community leaders whose cooperation is always important.

Through the generosity of Fox-West Coast Theaters, 150-foot trailers counseling care with fire and cigarettes in national forests were shown in more than 900 theaters throughout the State. Approximately 2,500,000 persons were reached by this means.

Talks dealing with the current fire hazard were delivered before numerous Los Angeles organizations by William V. Mendenhall, supervisor of Angeles Forest; DeWitt Nelson, supervisor of San Bernardino Forest; George H. Cecil, executive-secretary of the Southern California Conservation Association, and other persons acquainted with the problem.

Mr. Cecil's association concentrated particularly upon industrial house organs and the publications sent by public utilities to their hundreds of thousands of consumers. He induced such concerns as the Southern California Edison Company to enclose slips in payroll envelopes admonishing employees to refrain from carelessness with fire and cigarettes in forest areas.

Furthermore, Mr. Cecil provided radio stations with week end weather reports which included timely fire-prevention publicity.

Through the medium of lectures, slides, and silent and sound pictures presented to 469 groups of persons, such fire-prevention agencies at the Forest Service, the County Forester, and the Los Angeles Fire Department have made direct appeals for cooperation to nearly 80,000 people during 1941.

The James Montgomery Flagg poster "Yours in Trust" was distributed to scores of industrial plants for display on bulletin boards and to barber shops. Boy Scouts in several cities in the metropolitan area had the posters exhibited in the windows of many business houses.

To reenforce the publicity program, five additional fire-prevention employees were hired to serve as moving patrols in Angeles Forest. It was their task to contact forest users and watch for infractions of smoking and campfire rules. Extra men were also assigned to act as registrars to meet the public at forest entrances during week ends of heaviest use.

"Don't be a Flipper!"—This theme for a special poster that strikes a new note in Forest Service advertising resulted from a speech by DeWitt Nelson, supervisor of San Bernardino National Forest. Nelson declared in his talk that Southern California forests were as inflammable as a hula dancer's skirt. George H. Cecil, executive-secretary of the Southern California Conservation Association, had this remark converted into an attention-getting cartoon by R. H. Scribner. Thereafter, John P. Kaye of the Angeles Forest induced American Legion Post No. 570 to finance the printing of posters bearing Scribner's grass-skirted hula girl and cigarette-flipping hand. The Los Angeles Street Railway and the Pacific Electric interurban lines carried 500 of the posters throughout the county for more than a week. Probably close to a million persons repeatedly had an opportunity during that period to read these words:

DON'T BE A FLIPPER!

Forest Cover Will Burn Like a Grass Skirt

HELP PREVENT FIRE

FOR

NATIONAL DEFENSE

Subsequently, similar posters were used by San Bernardino Forest, which had the cooperation of its local Legion posts. The same forest employed the Scribner illustrations and an expanded message in getting out an attractive hula girl folder for distribution to deer hunters.

Fire-Warning Patrols.—The extensive use of Boy Scouts to act as pickets in crowded downtown business districts throughout the county, was contemplated in this phase of the program. The effort was only partly successful, because too few boys responded to make an impressive showing. Moreover, the posters and placards in stock were inadequate for the occasion. The Flagg posters were too small, and there were too few placards of the "Stamp it Out!" variety.

It was obvious enough from the lively interest aroused by the few fire-warning patrols appearing on downtown sidewalks that the idea

was sound. Therefore, it is hoped to make thorough preparation for its widespread use during the 1942 fire season. The Boy Scout organization has volunteered to man an "all-out" display in our behalf next year, promising to organize fire-warning patrols to "picket the public" (a term we refrained from using) each Friday in order that week-end forest visitors and vacationists will have a last minute reminder of the cooperation expected of them by the Forest Service.

A large number of specially-designed posters should be prepared during the winter months, and probably one of the trade schools will make the placards for nothing if materials are furnished. The plan is to have different sets of placards for each week end so public interest will not lag.

The 1941 experimental tryout of the idea, which was based on the fact that a moving sign is superior in attracting notice to one that is stationary, gained the cooperation of the police commission, which facilitated the picketing; a lumber company, which furnished 500 stakes for mounting the placards; two paper concerns, which furnished the heavy cardboard for backing the posters; and the C. C. C., whose boys put the picket signs together.

Fag Bags.—A small muslin bag, closed with a drawstring and bearing a "fire-conscious" pledge tag was originated in an effort to halt automatic smoking in the forest. All inveterate cigarette smokers know from experience that automatic smoking is the act of taking out a cigarette and lighting it without conscious thought. The purpose of the "fag bag" is to hold a smoker's package of cigarettes while he is in the forest and thus remind him constantly that he must smoke only in posted areas. The fact that he has signed the attached pledge card probably increases considerably the effectiveness of the bag in preventing thoughtless smoking.

Before the idea was put to the test Labor Day week end, it was submitted to psychologists and all agreed it should accomplish its purpose; namely, bring to the level of consciousness the habitual act of unconscious "lighting up." The psychologists advised that considerable care should be taken in presenting the bags to the public at the forest entrances. It was their suggestion that forest officers personally place smokers' cigarettes in the bags, in a good-natured and unpoliceman-like manner, at the same time offering a pen for the signing of the pledge tags. This advice was transmitted in a special memorandum to forest officers and they followed it well and with fine results.

The bags were made by the Los Angeles Girl Scouts for whom 500 yards of muslin was obtained. The Southern California Automobile Club generously furnished the pledge tags. In all, more than 10,000 fag bags were prepared for Labor Day week end, and a considerable volume of advance newspaper and radio publicity was obtained on this new approach to the long-bothersome problem of automatic smoking.

More than 97,000 persons visited Angeles Forest over the week end, and the bag supply was soon exhausted. The week end went by without a single fire in the forest's 690,000 acres. It would be impossible, of course, to allocate credit for this record, but probably part of it might properly be attributed to fag bags and the "smoke safely" stories that accompanied publicity about them.

Reports from registrars and guards who handed out the bags were very interesting, for they show that with only a few exceptions the bags were enthusiastically received. Indeed, some persons drove to forest entrances solely for the purpose of obtaining the bags, for they headed back to the city immediately after receiving the "habit-smashers."

Highways leading into the forest, above checking stations, were scanned for thrown-away bags, but none was found. It is likely the signed tags restrained the impulse of some to discard the bags.

Results of the Labor Day try-out were sufficiently encouraging to warrant plans for distributing the fag bags throughout the 1942 fire season. The Girl Scouts have given assurance that they will turn out several hundred thousand fag bags for next year. They expect to make the project their main activity during the Spring months.

How to provide additional material without expense, and at the same time widen the scope of public participation in the program, was a problem tentatively solved by a general appeal for flour, sugar, and salt sacks. An appeal was carried repeatedly by newspapers and radio stations. September 22 was designated by the Los Angeles Board of Education as Fag Bag Day in the city's 380 schools, which have 273,000 pupils. Again the Los Angeles Police Department cooperated by having their patrol cars pick up the sacks and concentrate them at their various substations where Forest Service trucks collected them. Enough material is now on hand to do part of next year's job. It is expected that additional sources of free supply will be uncovered before long.

All in all, fag bags seem to have caught the public fancy—so much so that within the first 10 days after their initial use they were made the subject of a 5-minute nation-wide broadcasts—by John B. Hughes of Mutual Broadcasting System, and by Kate Smith over Columbia.

Recently the fag-bag idea has been adopted by both San Bernardino and Cleveland National Forests. The Los Angeles Fire Department is studying the device with a view of recommending the use of similar bags to control smoking on the waterfront docks, and there is a report to the effect that the Consolidated Aircraft Company in San Diego may employ the bags in its plants.

A free lance writer furnished *Science Service* in Washington, D. C., with a brief story about the bags and the endorsement they received from Dr. Robert A. Millikan, Nobel prize winner and president of the California Institute of Technology. As a result, *Science Service* has obtained 5,500 fag bags for distribution to its subscribers throughout America.

Signals.—Fire Guard Oley F. Scott, has found that a police whistle is very useful on the fire line. He uses the whistle to recall the crew when a breakover or spot fire occurs that cannot be handled by the patrolman. Because of the noise created by a crew at work it is often difficult for them to hear an ordinary voice signal. On Scott's crew this difficulty has been eliminated by the use of the whistle.—E. W. Fobes, *district ranger, Mark Twain Forest.*

SOMETHING NEW IN PUMPS

George P. Melrose,

Assistant Chief Forester, British Columbia Forest Service

The author describes a new portable power pump which resulted from efforts to get extreme light weight coupled with dependability of operation. Although its output is much less than that of the portable pumpers used commonly in the United States, the author indicates possibilities of its employment where the larger pumps are not used.

A little water promptly and properly applied, will do more good on a fire than unlimited quantities poorly used and wasted. That "axiom" worked for years in the practical Scotch brain of Fire Inspector J. G. (Jim) MacDonald of the Vancouver Forest District, British Columbia.

Economy and mechanical engineering skill came naturally to Jim so he began to look around. He listened to hydraulic engineers with their discharge formulas, pressures and heads; he listened to mechanical engineers talking R. P. M.'s and brake horsepower; he listened to many a firefighter with his demand for more power, more pressure, and more water.

But Jim has fought fire for 30 years, has seen oceans of water pumped by high-pressure pumpers, and he still felt that there was great waste in power, weight, and cost in many cases where only a little water was needed quickly.

His experience also ran to pump troubles—to worn-out engines, conrods through the casings, flywheels twisted off, and the many other breakdowns that occur in high-speed engines run at top rating.

Jim decided he wanted an ultra-lightweight unit, operating at moderate speeds, delivering a fair stream of water and complete in one pack. After a couple of years experimenting, discarding, redesigning, and trying in the field he has now produced a pumping unit that has the earmarks of a highly useful tool. It is complete to suction and discharge hose, nozzle, gasoline, and universal tool in one 60-pound pack. Here are the specifications:

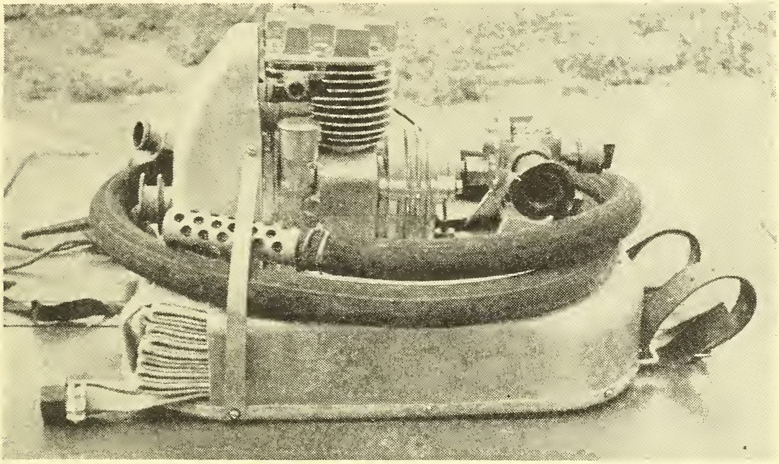
Length over all 18 inches.
Width over all 15 inches.
Height over all 13 inches.
Weight, complete with 100 feet of 1-inch linen hose—60-61 pounds.
Motor—1 h. p., air-cooled, 4-cycle Lauson, governor controlled to 2,800 r. p. m.
Pump—1-inch geared.
Coupling—3 : 2 reduction gear in air-cooled housing.
Base—Aluminum, shaped to fit back; pack straps attached.
Gas-tank—in base; capacity 3 pints, sufficient for 4 hours' operation.
Hose, discharge—1-inch linen; 100 feet carried in base.
Hose, suction—1-inch rubber garden hose with aluminum strainer.
Nozzle—$\frac{5}{16}$ inch.

The revolutionary part of the pump is not the size or weight but the gear-reduction coupling. It was this coupling that permitted the use of such a small motor and low speeds. It operates a pump

Portable pump and hose as carried on back.

that, directly connected, requires a 3–3½ h. p. motor and operates efficiently below its maximum rating.

The pump will not eliminate any of the various excellent pumps now on the market. They have their place most decidedly in the protection picture, but where men are scarce and the country is rugged, where water is needed quickly at strategic places and possibly the supply is small, this unit will give value. One man can pack and operate it. The reliable little engine plugs along without attention. If a change of hose is needed or another length needs to be added, the stream is stopped by simply lifting the suction hose out of the supply without danger of burning out the motor or delay in restarting.



Portable pump and hose.

Delivery of water in the experimental model is about 10 gallons per minute at 65 pounds pressure through a 5/16-inch nozzle. A 63-foot stream through a ¼-inch nozzle is obtained through 1,000 feet of 1½-inch linen hose with an elevation of about 25 feet.

Those are the only figures Jim MacDonald will quote on performance. He is content with the facts that he gets a fair stream and can now quote experience of rangers and other fire fighters who have used experimental models and found that this little gadget is useful in many spots where other pumps would not or could not be used.

And finally—economy. The units are cheap to build compared to present standard pumpers. The comparison must, of course, be local, but experience indicates a proportion of at least 2 to 1 and maybe 3 to 1.

The British Columbia Forest Service has now had a dozen units built for field use next year. It is possible that it can be improved, but only use on the fire line will tell.

425851—41——3

A FIRE-DISPATCHING GUIDE FOR USE IN THE LAKE STATES

J. A. Mitchell

Lake States Forest Experiment Station

While judgment cannot be dispensed with in fire dispatching, information as to normal manpower requirements is useful as a guide. The device described is an attempt to supply this information in convenient form for field use.

The Lake States fire-dispatching guide is designed to indicate the manpower normally required to control forest fires in northern Minnesota, Wisconsin, and Michigan within the time allowed by local Forest Service standards. That is within 5 hours in the case of "low" rate-of-spread fuels, 4 hours in the case of "moderate" rate-of-spread fuels, 3 hours for "high," and 2 hours for "extreme." Essentially the device is a slide rule with scales for each of the factors considered which, when combined, indicate the average number of men required to control fires with hand tools under the conditions set up.

The factors considered are (1) Danger or burning conditions as indicated by the Lake States fire-danger meter, (2) wind velocity, (3) travel time, and (4) fuel-type class based on rate of spread and resistance to control.

To use the meter both slides are grasped at (A) and pulled out until the end of the long slide coincides with the current "Wind velocity" on the wind scale opposite the degree of "Danger" prevailing. Next, the short slide (B) is set for "Rate of spread" class on the scale opposite the "Travel time" called for. The "Number of men" required is then indicated on the top scale by the arrow for the appropriate "Resistance to control."

For example, if the meter is set for a class 5 day, a 10-mile wind, 1-hour travel time, and high rate-of-spread fuel, the average number of men needed, in the case of moderate resistance to control, is 14 as indicated by the arrow marked "Moderate," while "Low" resistance to control calls for 7 men, "High" 28, and "Extreme" 56.

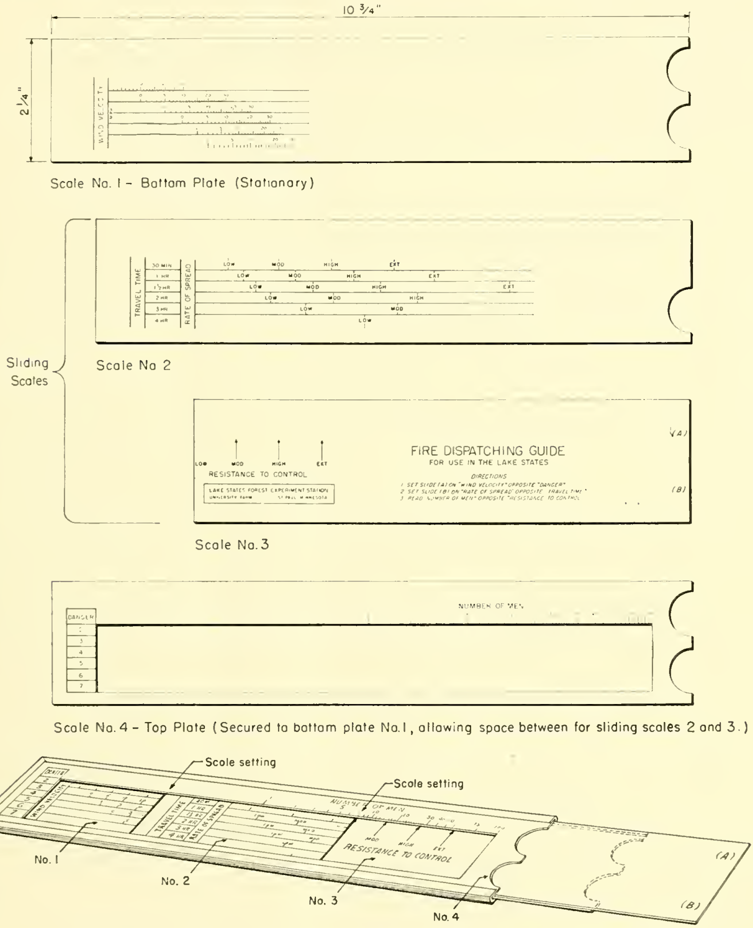
The fuel-type classes used are those adopted by the Forest Service in region 9, which classifies fuels on the basis of their average rate of spread and resistance to control on class 5 days with a 4- to 7-m. p. h. wind. Rate of spread is defined as the increase in the perimeter of a fire in chains per hour and resistance to control, as the ratio of final perimeter to man-hours required for control (exclusive of mop-up and patrol). On this basis the average rate of spread and resistance to control for the fuel type classes recognized are: Rate of spread—"Low," 8 chains per hour; "Moderate," 16; "High," 32; "Extreme," 64. Resistance to control—"Low," 8 chains per man-hour; "Moderate," 4, "High," 2, and "Extreme," 1.

In practice, rate of spread and resistance to control are determined by reference to a map showing the fuel type class prevailing on the area in question. In the same way travel time is usually determined by reference to a map showing the time required to reach any point on the protection area from the nearest established base.

The computation of manpower is based on the formula

$$N = R/2C + RT_1/T_2C$$

in which $R/2C$ equals the number of men required to offset the increase in the perimeter of the fire after attack begins and RT_1/T_2C the num-



Fire-dispatching guide as constructed and assembled.

ber required to control the fire burning on arrival, N being the total number of men required, R the rate of spread in chains per hour, C resistance to control in chains per man-hour, T_1 the elapsed time from origin to arrival, and T_2 elapsed time from arrival to control.

In calibrating the meter, elapsed time from origin to arrival (T_1) is assumed to be travel time plus ½ hour. If known to be more or less, the difference can be allowed for by using a correspondingly longer or shorter travel time in setting up conditions on the meter.

Since empirical values are used in its calibration the meter is not recommended for use outside of the Lake States. The formula used in computing manpower and the method of integrating the various factors, however, are applicable generally.

No dispatching table or meter should be followed blindly as local conditions often call for special consideration. In such cases there is no substitute for experience and good judgment. All a dispatching guide can do is to indicate normal requirements as a check on judgment.

In practice the tendency is to overman fires when conditions are favorable and to under man them when conditions are critical. This results in a waste of effort on small fires and allows bad fires to get away. There may be some excuse for overmanning small fires in the interest of safety but undermanning bad fires is serious. The trouble appears to be a lack of appreciation of the rapid increase in rate of spread with wind velocity in the higher danger classes, particularly when high rate-of-spread fuels are involved. The importance of adequate first attack cannot be overemphasized if area burned is to be kept small. The fire-dispatching guide serves to call attention to conditions which require increased strength of attack.

More About Burros.—The suggestions made by J. H. Sizer about burros (Fire Control Notes, July 1941, paragraph 5, page 142, "Fire Control Work in Isolated Sections") seem very impracticable, judging from our experience with burros in these mountains a few years back. Perhaps, however, Sizer has a different kind of burros than we had, or some burro tenders who know a lot more about such animals than do ours.

Burros may be all right in a fairly level country, where you can herd them around, but ours were decidedly poor animals to try to lead around very much, being slow and stubborn. When you turn them loose and expect one to follow the others, you are again disappointed in being able to get them to travel at more than a snail's pace. If you then try to herd them along to get more speed out of them, they crowd each other off the trail and roll half of the string down the mountainside. You then spend the balance of the day, or night, packing the equipment back onto the trail (the part worth packing back) and getting the rolled burros back, if you don't have to dispose of them for injuries. They are tough though and can stand a lot of rolling.

The burros can be subsisted cheaply and will stick around camps quite well for a short time if a constant check is made on them and they are fed something at camp. Otherwise, they wander farther and farther away and eventually will wind up back at the ranger station, or other main base camp, or home range. Each camp has to be protected by a good pole fence or barricade of some kind unless a watchman is left in camp to keep the burros out during the absence of the crew.—Lester D. Robinson, *district ranger, St. Regis District, Cabinet National Forest.*

MAPPING ACTIVITIES OF THE WISCONSIN CONSERVATION DEPARTMENT

John W. Ockerman,

Principal Topographer, Forest Protection Division, Wisconsin Conservation Department

Maps and the theories and practices underlying their construction are often not understood even by those who use them. The author mixes together a little history, a little theory, and a little practice in such a manner as to dispel some of the mysterious aura surrounding maps.

A map is not just an abstract plan of a portion of the earth's surface but in reality is a piece of equipment. In the case of the forest-protection division, it is an important part of the fire-control equipment. It does its part in locating the fire, in the rapidity with which the men get to the fire, in the location of water supplies, and in the general plan of attack.

But in addition to being purely utilitarian the map is an important adjunct to recreation. It helps in the planning of trips, whether on land or water, and adds enjoyment to the vacation by revealing new places to explore. The map helps the air traveler and orients the continually changing panorama of lakes and woods so that he may fly safely.

Before we plunge into the actual business of map making, let's look backward into the history of mapping. A review of deficiencies and idiosyncrasies of the earlier maps will tend to give added weight to the qualities of our present maps and a greater appreciation of the maps now available.

The first prerequisite of a map is that it have a definite scale so that distances can be denoted. Actually measurements on the ground were made as early as 1300 B. C. in the survey of the Nile land, but the standards of measurement were extremely confused up to the eighteenth century. For example, in 1781 the map of France had 20 different scales shown on it. In 1789 the map of England showed 3 miles, the long, the mean, and the short mile.

The second need for a map is direction. Distance without direction is meaningless. Prior to the advent of the compass, maps were based on religious or geometric principles and consequently were pictures rather than maps as we now think of maps. The reverence for the east was pronounced, and east dominated the maps even after the compass made its appearance. We still say "orient" a map, but we orient it to north instead of east now.

To put a map together it is necessary to have a plan or projection by which the data can be assembled. A projection may be defined as a systematic drawing or meridians and parallels on a plane surface. Though projections were devised by Ptolemy, none was used until the

eighteenth century. We now have our prime meridian running through Greenwich, England, but in the earlier maps using projections, the prime meridian was put in many places with resulting confusion.

As can be seen, mapping is a relatively new science. Certain phases of it are extremely new, and advances are continually being made in both the technique of mapping and the finished product.

The map section at the forest-protection headquarters at Tomahawk, Wisc., is actively engaged in the preparation of several types of maps, the most important being the forest-protection maps. Since one of the principal uses of these maps is to locate fires by intersection, accuracy is of prime importance. To accomplish this it is necessary to have an accurate base, precise control, and as good cultural data as possible.

For constructing the base the polyconic projection has been selected. This projection is well adapted to Wisconsin and facilitates the use of data from the United States Geological Survey and the United States Coast and Geodetic Survey. The maps are constructed on drawing paper, mounted on either side of a sheet of aluminum. This base minimizes the distortion due to shrinking or stretching of the paper and gives a very permanent master copy. The base map is drawn on a scale of 8/10 inch per mile and is called a quadrangle. It is 30 minutes of latitude and 30 minutes of longitude on a side, which translated into miles is approximately 25 miles east and west and 35 miles north and south. These quadrangles are so drawn that several can be assembled to form whatever size area is desired.

After the polyconic base has been constructed, the control points are then accurately placed on the outline. These control points consist of fire towers, United States Coast and Geodetic triangulation stations, water tanks, and other tall structures for which there is a precise location. In 1934 the United States Geological Survey triangulated all the fire towers in Wisconsin and furnished us with their precise positions in latitude and longitude as well as distance between adjacent towers. From this data it is possible to plot the position of the towers very accurately on the maps. The tower control is supplemented with other triangulation stations which are parts of several major control networks in Wisconsin. All of these towers and stations have been tied into the Government land survey, and it is possible to build the land survey lines around these control points quite accurately. Whenever possible, surveys of Government agencies are used in laying out the land lines.

The final stage in the construction of the quadrangle is filling in the cultural data. During the last few years the entire State has been photographed from the air, and it is from these pictures that the lakes, streams, roads, trails, railroads, etc., are taken. These pictures, of which there is a complete set at the office of the Highway Commission in Madison, were taken at approximately 15,000 feet altitude with a single lens camera. The original pictures are 7 by 9 inches in size and are on the scale of 1/20,000 or about 3¼ inches per mile. At the time the pictures were being taken many land corners were marked with cheesecloth crosses so that they could be located and identified on the pictures. This was extremely important in

areas where there were few roads and little cleared land that might help to identify the land lines and corners.

By the use of a suspended pantograph, on which the slight variations in scale can be corrected, the information from the pictures is reduced to 2 inches per mile, and compiled in township form on what is called a topographic base map. On these bases are shown the original meander lines and Government lots, present lake outlines and stream courses, roads, trails, fire lanes, towers, telephone lines, and all information pertinent to fire-control work. These maps are sent out in preliminary form to the respective district rangers for field check as to road types, names of lakes and streams, and any additions or corrections to get the map as complete and correct as possible. When these have been returned and corrections have made on the original tracing, sets of these maps are issued to the districts to be used for compiling varied data such as tree plantings, hazard zones, burned areas, etc., as well as new information on roads, towers, etc., and for future correcting of the quadrangle map. It is from these corrected topographic base maps that the cultural data for the quadrangle is secured, and it is transposed or pantographed onto the quadrangle map.

When the quadrangle map has been completed, it is photographically reproduced to scale and printed on a uniform type of paper so that several can be matched and mounted for the large wall maps or dispachers' maps. In the case of the latter, 6-inch protractors are overprinted in red ink at each tower position, the zero of the protractor being oriented to true north, as are the protractors in each of the fire towers.

The district maps are issued on the scale of ½ inch per mile and are made by assembling as many quadrangles and parts of quadrangles as lie within the district boundaries. When the maps have been put together and a border and legend has been constructed, the composite is photographed down in scale from 8/10 to ½ inch per mile. In addition to the black and white maps, a portion of the district maps are issued with red tower protractors superimposed over each tower.

In addition to the forest-protection quadrangles, topographic base maps and district maps, there are several other types of maps produced by or issued from the map section at Tomahawk.

Ground-water survey maps are similar to the topographic base maps in scale and make-up, but in addition to cultural data they show the ground-water conditions. After a careful study of the township has been made to determine the location and amounts of ground water, and test wells have been sunk, this information is incorporated in a ground-water survey map. These maps are useful tools in fighting fires in areas of little or no surface water.

Lake survey maps, showing the depths, weed beds, bottom materials, etc., prepared under the supervision of the biology division, are issued from the Tomahawk office.

In addition to miscellaneous maps and plats of surveys, such as fire lanes, ranger station sites, state properties, etc., many building plans have been prepared at this office, ranging from small tower cabins to large ranger stations and garages, and many drawings of equipment have likewise been prepared and issued at this headquarters.

A SIERRA RATION AND EQUIPMENT OUTFIT

Ralph L. Cunningham and Wesley W. Spinney

Sierra National Forest

The Sierra National Forest (California) is divided roughly north and south by the San Joaquin River which runs west and southerly toward the main valley. The canyon formed by this river in the Sierra is steep, rugged, inaccessible.

The forest cover is highly inflammable. In the southern end of the canyon it consists largely of scrub oak, grass, and brush. The middle and upper portions break away into ponderosa pine and sugar pine with some fir and cedar in the upper reaches.

Whenever a fire starts in the canyon area, it usually covers considerable acreage and is very costly to control. Because of the prevailing high-velocity SW. winds, sometimes reaching 30 to 35 miles per hour, fires travel up the canyon rapidly during the day. The topography and lack of roads in the area make travel to a fire slow. Precipitous canyon walls and lack of transportation facilities also make it impossible to put fire camps in close proximity to the fire. Consequently, line crews are obliged to do considerable walking, which cuts deeply into the daily line production. Some of the canyon country is too dangerous for CCC crews.

In searching for means of eliminating the use of CCC crews and of reducing excessive walking, the personnel of the Sierra decided upon a modification of the 40-man suppression crew used in Region 6 (Described in Fire Control Notes, April 1940, The 40-man Crew—A Report on the Activities of the Experimental 40-man Fire-Suppression Crew). Fortunately local Indians, loggers, and residents who are familiar with the country and who depend upon a certain amount of income from fire fighting each year are available for use in organizing fire crews. Local experience has indicated that large crews are not necessary down deep in the canyons, but that small compact units located at strategic places will suffice in a good many cases.

With the local situation and problems in mind and looking ahead to future canyon fires, "blitz-blaze" ration and equipment outfits were made up. They were so planned that a man might subsist alone for at least 72 hours if he were left on patrol work or the outfits might be combined into ten 12-man set-ups in case a temporary camp were established. Since each outfit is self-sufficient, the size of the crew can be enlarged simply by adding another man and pack.

Each outfit complete weighs in the neighborhood of 40 pounds and can be handled by the average man, while in good shape, going

into the fire. If necessary, the packs and equipment can be brought out by stock or by a fresh crew after the fire had been controlled.

One man in each group of 12 carries a supplemental cooking outfit. Contents and weights of different items in the Sierra outfits follow:

1. Individual crew member pack:

Article	Amount	Weight in ounces	Article	Amount	Weight in ounces
Roast beef ... cans	3	36	Peaches, sliced ... cans	2	16
Butter ... can	1	13	Milk, evaporated ... can	1	14½
Date-nut bread ... do	1	8	Spaghetti ... do	1	15¾
Raisins ... package	1	15	Pork and beans ... do	1	30
Prunes ... do	1	16	Canteen with cup and cover ... quart	1	16
Macaroni ... do	1	16	Army mess kit with knife, fork, and spoon ... can	1	16
Sausage, breakfast ... cans	2	21	Army blanket, W. O. D.	1	48
Cheese ... can	1	7¾	Zweiback ... package	1	6
Bread, brown ... cans	2	32	Granulated sugar ... do	1	16
Coffee ... can	1	32	Headlamp, new 4-cell type	1	48
Potatoes, peeled whole, new ... can	1	20	Salt and pepper (mixed) shaker	1	8
Rice ... package	1	16	Knapsack	1	16
Soap, Lava hand ... bar	1	6	F. M. B. file 8-inch	1	01
Soup ... can	1	10½	Matches, paper	1	1
Tomato juice ... do	1	15	Socks, towel, tooth brush, etc.	----	16
Jam ... do	1	24			
Grapefruit ... do	1	8			

Total weight knapsack and contents	pounds	34.4
Average weight of fire tools	do	6.6
Total weight of outfit	do	41.0

2. Items in cook's knapsack:

Article	Amount	Weight in ounces	Article	Amount	Weight in ounces
Blanket, W. O. D.	1	48	Tea, black	1	8
5-gallon can, square	1	40	Dipper, tin	1	4
Dish towels	3	16	Fry pans, folding	2	48
Spoons, table	5	16	Soap, laundry	1	12
Knife, butcher	1		Dry soup, mixture	2	16
Cheese	1	32	Army meat, can with knife, fork, and spoon	1	16
Matches, penny size	2	2	Canteen, 1-quart, with cup and cover	1	16
Coffee	1	8	Nails, assorted	----	16
Roast beef	3	36	Soap, bar Lava, hand	1	16
Date-nut bread	1	8	First-aid kit	1	16
Sandwich spread ... quart	1	32	Salt pills (100) ... bottle	1	10
Butter, canned	1	13	Gasoline lantern with extra mantles	1	80
Milk, tall, evaporated	2	29	Knapsack	1	16
Pepper (can)	1	2			
Pickles, dill	1	26			
Flour	2	80			

Total weight, 40¾ pounds.

Small articles are rolled in three 10-pound cloth sacks—sacks to be used to carry lunches if necessary, or as towels otherwise.

One W. O. D. blanket is sufficient for most mid-Sierra summer nights. However, if the shift system is used, each man will have access to an extra blanket.

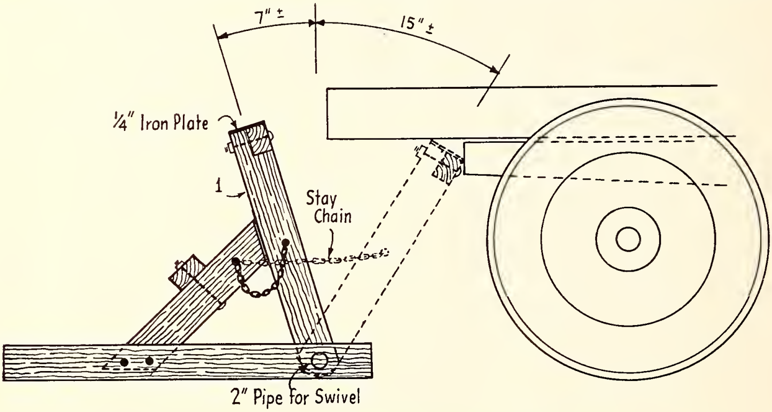
Although the outfits described may not be perfect in food and calory content, they should enable the crews to get by in good shape for at least 3 days. They were made up of standard R–5 equipment and of supplies on hand insofar as was possible. Nonperishable items, such as canned meat and butter, were purchased specifically for such use. The plan would be to supplement the rations and supplies with a radio

set, light batteries, fresh meat, bread, water if necessary, and sharp tools delivered either by pack train or by plane when possible.

The man in charge of each crew must be trained in the use of the ration and supply outfits. When the crew is grouped together, he must see that the food is pooled in order to prevent waste and spoilage. He must also "rough out" menus in order to make the rations last.

It must be remembered that the "blitz-blaze" outfits have been made up for use in cases of emergency, in a hazardous area where a few men can do the job, and where decreased walking time and increased line production are necessary for prompt control of fires. Their value and practicability are yet to be tested by actual use on the fire front.

Relieving Weight From Overloaded Truck Springs.—Shown on the accompanying sketch is a design for relieving weight from overloaded springs on trucks where it is necessary to keep the truck loaded for any length of time. This model was designed and built by mechanic Herman Isbell at Camp F-12, Stearns, Ky., for use in relieving springs on a fire truck that is constantly loaded.



Apparatus to relieve weight from truck springs.

The material consists of 3- by 4-inch piece of oak or equivalent wood and a 2- or 3-inch pipe for swivel or axle. The distance and arch can be varied to suit height of truck frame. If necessary, a chock block for the truck can be added. Note that the vertical piece (1) should be low enough that the truck can maneuver on and off jack under its own power.—*Cumberland National Forest.*

COMPARISON OF 1-, 2-, 4-, 6-, AND 8-MINUTE WIND-VELOCITY MEASUREMENTS

William G. Morris

Pacific Northwest Forest and Range Experiment Station

Wind velocity for fire-danger rating is often estimated for a given period of the day by making brief measurements with a wind gage at certain observation times. One type of gage in widespread use is designed for a 1-minute count of the revolutions to obtain the wind velocity, and another type is designed for a 2-minute count. It is frequently suggested that a period several times as long should be used so as to average the irregular effects of gusts. The following article gives results of a study to determine the relative desirability of different velocity measurements ranging from 1 to 8 minutes in length.

Wind velocity is an important factor in rating forest-fire danger in R-6. In present practice it is measured by a 2-minute observation at 8 a. m., noon, and 4:30 p. m. Either the noon or afternoon measurement is usually used with the current fuel-moisture measurement to determine the rating of fire-weather conditions.

The rating of fire weather is intended to represent conditions during a considerable proportion of the afternoon and not just the conditions at exactly noon or 4:30. It would be more desirable to have a continuous record of wind velocity and fuel moisture, but available recording instruments are too expensive. A greater frequency of 2-minute observations also would be desirable, but other duties of the observers prevent this at many of the observing stations.

It is known that fuel moisture usually changes rather gradually and steadily in a certain pattern during the afternoon but wind velocity may fluctuate greatly from minute to minute or hour to hour. The study to be described as made, therefore, to obtain an estimate of the reliability of short observations of wind velocity when used to represent prevailing conditions for the afternoon during a period that was chosen arbitrarily to be 2½ hours in length.

The general method of study was to measure wind velocity for each minute during an 8-minute period. The 8-minute periods of measurement were repeated 10 times during each afternoon and were begun at 15-minute intervals. A Friez aneomometer with three 2⅞-inch cups and with buzzer contacts every $\frac{1}{60}$ mile were used. The observations were taken on 5 days on a mountain top when the wind velocity averaged from 7 to 11.5 miles per hour for the afternoon period sampled, on 3 days on the mountain top when the wind velocity averaged from 3.5 to 5 miles per hour, and on 10 days in a 1-mile-wide valley when the wind velocity averaged from 2.8 to 4.4 miles per hour.

The measurements for each minute in the 8-minute period were later grouped to form observation periods of differing length. Thus 1-minute, 2-minute, 4-minute, 6-minute, and 8-minute periods of observation were obtained for comparison. The fifth minute in the series of 8 was used in each case as the 1-minute measurement period. The fourth and fifth minutes were used as the 2-minute measurement period. The third, fourth, fifth, and sixth minutes were used

as the 4-minute period. The second to seventh minutes were used as the 6-minute period. Thus each long period included each shorter period.

The manner in which the observations differed from each other owing to variations in wind velocity between different hours of the afternoon, different periods within the hours, and different lengths of observation was studied by methods of statistical analysis. These methods were used also to obtain estimates of the comparative reliability of single observations differing in length and used to represent the average velocity for a 2½-hour period.

The fact that all observations were taken at regular intervals of 15 minutes instead of at random casts a certain degree of doubt on the interpretation of statistical measures designed for use with random distributions. If the wind should show a tendency to rise and fall in 15-minute cycles the results of random sampling methods of analysis certainly could not be correctly interpreted for the data collected in this study.

The velocities observed during the first, fifth, and eighth minutes of each 8-minute period were analyzed to determine if there was any tendency for 15-minute cycles to occur and none was found. Continuous automatic recordings of wind velocity at the valley station during two summers have been inspected and no regular pattern of wind velocity variation during the afternoon could be found. The writer feels safe, therefore, in using methods designed for random sampling to estimate from the present data the reliability of 1-minute, 2-minute, 4-minute, etc. measurements.

The wind velocities for afternoons of low average velocity and for relatively high average velocity showed that these two groups should be studied separately. The data taken on afternoons of low velocity on the mountain top and on afternoons of low velocity in the valley did not differ and were grouped for analysis. Thus the results will be discussed separately for afternoons on which the wind velocity averaged from 7.0 to 11.5 miles per hour on the mountain and for afternoons on which it averaged from 2.8 to 5 miles per hour at the valley and mountain-top station.

Following are some of the probable limits of accuracy to be expected when the average velocity for a 2½-hour period is estimated from measurements of short duration:

Afternoons on which the velocity averagee 2.8 to 5 miles per hour

	Length of measurement period—minutes				
	8	6	4	2	1
Expected maximum error in miles per hour for 1 measurement [1]	1.8	2.1	2.1	2.7	2.9
Number of measurements needed to obtain an average having a maximum error of 3 miles per hour.[1]	Less than 1.				

Afternoons on which the velociuy averaged 7.0 to 11.5 miles per hour

	8	6	4	2	1
Expected maximum error in miles per hour for 1 measurement [1]	4.8	4.8	5.0	6.2	7.2
Number of measurements needed to obtain an average having a maximum error of 3 miles per hour [1]	2.5	2.6	2.8	4.8	5.8

[1] In 95 percent of infinite cases. From 1.96 X S. D.

These data show: (1) Short-period measurements of wind velocity used as estimates of the average velocity for a 2½-hour period had a much greater error in terms of miles per hour for average velocities of about 7 to 11 miles per hour than for average velocities of about 3 to 5 miles per hour. (2) With either wind-velocity class the accuracy of estimating a 2½-hour average from brief measurements increased as the length of measurements increased, but the increase in accuracy was small for measurements longer than 4 minutes.

From another analysis it was found that in most cases there is more difference in velocity between the first, fifth, and eighth minutes within the same 8-minute period than there is between different 8-minute periods spaced 15 minutes apart. This shows that the use of a measurement period several minutes in length will add more to the accuracy of estimating the average 2½-hour velocity than will several short measurements 15 minutes apart.

It was found that on certain days there was a significant difference in average velocity between the first and second 1¼ hours in the 2½-hour period when compared to the difference among the velocities recorded every 15 minutes. On most of the days this difference between 1¼-hour periods was not significant. Definite conclusions concerning the chance that the first and second 1¼ hours will differ in average velocity cannot be drawn from the available data because a sufficient number of days were not sampled.

The fluctuation of wind velocity during a 2½-hour period in the afternoon in some localities might be greater or smaller than found in this study and correspondingly the expected maximum error of one measurement and the number of measurements needed for an average of given accuracy would be greater or smaller. But experience in recording the duration of gusts makes it appear probable that the comparative desirability of measurements 1, 2, 4, 6, or 8 minutes in length to represent the average for a 2½-hour period in the afternoon in most places will be approximately the same as found in this study. These results may be used at least as a guide in other localities to determine the length of wind-measurement period that should be used until more intensive studies can be made. Additional studies for velocities over 12 miles per hour are especially needed.

The following conclusions and recommendations have been drawn from the study: (1) An observation period at least 4 minutes long should be used in estimating afternoon wind velocities of about 3 to 12 miles per hour. This may be done with wind gages designed for 1-minute observations by counting the contacts for 4 minutes and dividing the total by 4. Similarly, for gages designed for 2-minute observations count the contacts for 4 minutes and divide by 2. (2) If a 2½-hour average velocity is to be estimated from short observations, and if the velocity is between about 7 and 12 miles per hour, it is highly desirable to obtain several measurements scattered through the 2½-hour period. Three such measurements each 4 minutes in length will be necessary if an average with a maximum error of about 3 miles per hour is desired. (3) If a 2½-hour average velocity in the range of velocities less than 7 miles per hour is to be estimated one measurement 4 minutes in length will be sufficient for many purposes, because it can be expected to fall within about 2 miles per hour of the 2½-hour average.

A GOOD SUPPRESSION RECORD

C. R. Byers

Assistant Supervisor, Lolo National Forest, Region 1, U. S. Forest Service

Steve Doyle, CCC foreman, Camp F–42 on the Lolo National Forest in region 1, was stationed at Fort Missoula Spike Camp during the 1940 fire season. He had charge of a crew of 15 men who were maintained and trained as a fire-fighting unit. The regular course of fire training was given, plus continued special training.

Part of the training was given while burning firebreaks around Fort Missoula and Waterworks Hill in grass types. The special training continued in the use of the Bosworth trencher, the step-up method, the one-lick method, direct attack, and other methods on early small fires. Every advantage was taken of the opportunity, for training both off and on the early season fire job.

The crew was on 12 fires during the summer, ranging in size from a ½-acre fire to the Jones Creek fire of more than 4,000 acres on the Lewis and Clark National Forest.

On the Post Office Creek fire in the Lochsa Canyon, the crew drove to Jerry Johnson Lookout which required approximately 8 hours' travel time from Missoula. After arriving at Jerry Johnson the crew hiked down to the fire, a distance of approximately 5 miles and arrived on the fire line at 10:15 p. m. The 15 men completed 75 chains of fire line by 10 o'clock the next morning. That is at the rate of 0.42 chains per man-hour, not allowing any time out for rest or lunch. The resistance varied from medium to heavy-medium. The line constructed all held.

A functional-unit organization was used on the Post Office Creek fire. First came five ax men, then two saw crews, then a five-man trench and swamper crew, and one water buck. If the ax and saw gangs got too far ahead of the trenching crew, they worked back and helped swamp out and trench. The crew was kept in as compact a unit as possible, yet providing adequate spacing to meet the needs of the job for safety.

During the summer, Foreman Doyle's crew lost only 1½ chains of trench (caused by a burning log rolling across the line). They traveled 1,800 miles by truck and more than 100 miles on foot.

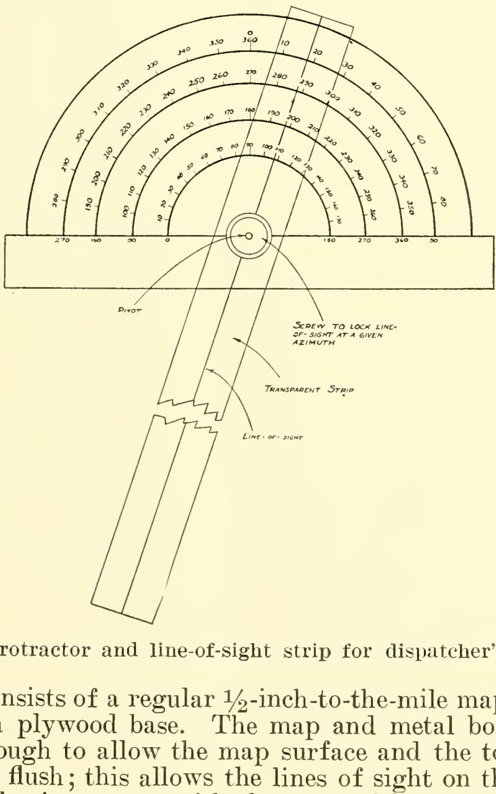
No doubt there have been many other crews similarly trained which have functioned with comparable success. Nevertheless, a comparison of the record of this compact, well-trained crew with the average performance of a few years ago, and even with recent records of what has happened on fires where unskilled men have been used, appears to prove that more and better training will pay big dividends.

A TYPE OF MAPBOARD AND PROTRACTORS FOR DISPATCHER USE IN LOCATING FIRES

LAWRENCE W. ZACH

School of Forestry, Oregon State College

Accompanying diagrams show the type of mapboard used in dispatching on the Coeur d'Alene District of the Coeur d'Alene National Forest at Coeur d'Alene, Idaho. This system of map and protractors was designed and developed by W. W. Larsen, district ranger, and H. Flodberg, alternate ranger, about 5 years ago. They have used this board and protractors every season since their development, and they report the board superior to any device previously used.

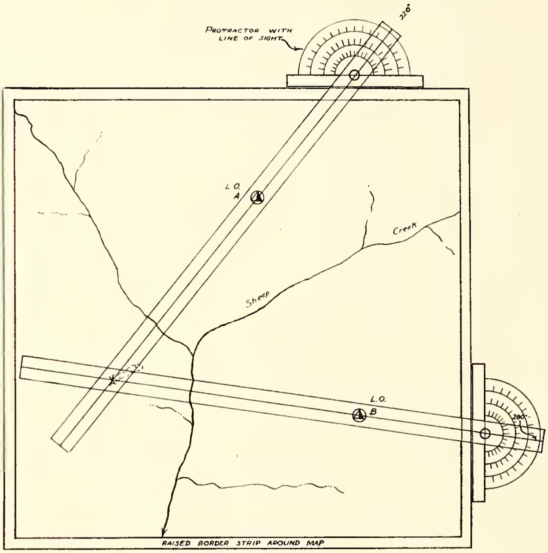


Detail of protractor and line-of-sight strip for dispatcher's mapboard.

The map consists of a regular ½-inch-to-the-mile map of the forest mounted on a plywood base. The map and metal bordering strips are raised enough to allow the map surface and the top of the protractors to be flush; this allows the lines of sight on the transparent strips to lie flat in contact with the map. These lines of sight are drawn on transparent celluloid strips which fasten to the protractors

as shown in the diagrams. The map and surrounding strips are oriented to lie in the cardinal directions. Screws through the metal border strips and base allow the map and strips to be properly oriented, using slotted holes.

The protractors are divided for azimuths, as shown by the protractor diagram. This allows the lookout's azimuth to be set off on the protractor and the line of sight to be fixed securely by the screw on the protractor. The protractor is then moved along the proper side of the board by the dispatcher until the line of sight



A - Lookout giving az. of 220° to fire
B - Lookout giving az. of 280° to fire
x - Location of fire

Dispatcher's mapboard with protractor.

crosses the lookout location from which the reading was reported. The second protractor is similarly used to set off an azimuth from any other peak reporting the fire and the location of the fire is then indicated by the crossing of the lines on the transparent strips.

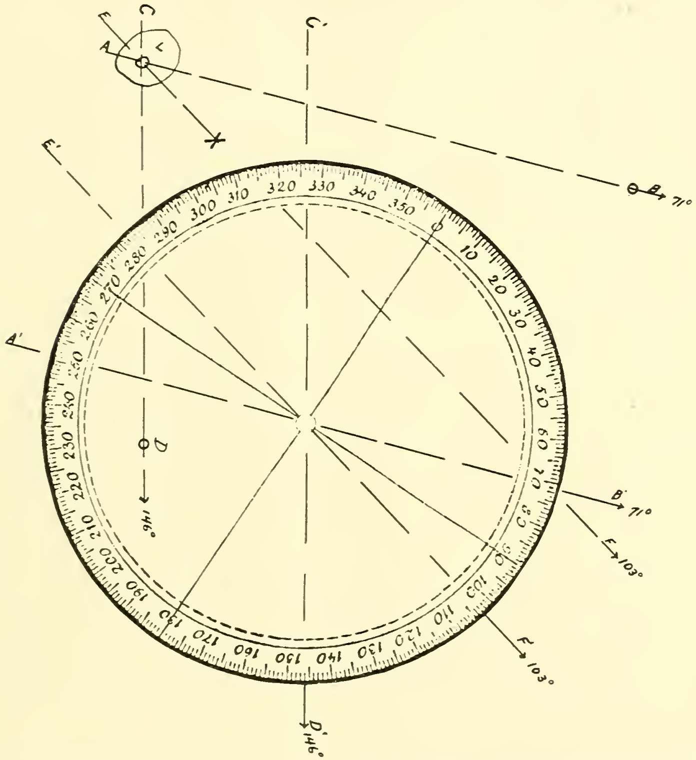
Larsen and Flodberg report that this mapboard with the protractors is unsurpassed for speed, accuracy, clearness of vision, and ease of operation. No lines need be drawn, and no confusing set of azimuth circles and strings clutter up the mapboard; the entire face of the map is entirely visible at all times.

A PARALLEL RULE FOR SMOKE CHASERS

F. E. Williams

Assistant District Ranger, Nezperce National Forest, Northern Region

The compass and protractor have been stressed in guard schools as means of orientation and of drafting courses to fires. The value of such training cannot be overemphasized. However, I have observed that the compass-and-protractor method has not been, shall we say, "comprehensible" to all of the guards. Why? It may be our fault as trainers, but, nevertheless, it is not used to the extent desired.



Method of obtaining the location of a smoke chaser en route to a fire and the proper azimuth to reach a fire.

Why not teach the men to reach the same objectives, in a simpler way, but avoid converting back shots to foresights in orientation, avoid converting azimuth readings for a 180° protractor, and other confusing motions?

Why not use full azimuth circles on our smoke-chaser maps, the number of circles depending upon the size of the map? One circle

will do for a small map, and more for larger maps. A parallel rule may be made out of a piece of plastacele (my sample is 4 x 9 inches), with parallel lines 1/8 inch apart etched in the plastacele, the lines running the long way of the plastacele. The advantages of the solid piece over an adjustable rule are obvious. This rule may be used on either a solid piece, rolled map, or a cut and folded map. For a folded map the line is marked at the edge of the piece map with the azimuth circle, then extended directly opposite to the edge of the next piece. The parallel rule is again laid on the original line and a parallel line is used from the edge of the second piece. The parallel rule will roll up with a rolled map, and may be placed flat with a fold-up map.

The diagram illustrates use of the parallel rule with an azimuth circle on the map that the smoke chaser carries with him in the field. The azimuth circle is stamped by means of a rubber stamp at a convenient point on the map where the center opening will be clearly visible. Its purpose is to enable the smoke chaser to draw lines on the map at certain azimuth readings, the parallel rule enabling him to carry the lines through specific points on the map.

A smoke chaser en route to a fire at X, a known location on the map, finds an opening (irregular area L) in heavy timber. He knows the fire is in heavy timber and wishes to locate himself and draft a course to fire X. His compass reads 71° on point B, and 146° on point D, both of which he can identify on the map. He places his parallel rule across the azimuth circle on 71°, line A^1B^1, and finds a parallel line running through point B, line AB; then he knows he is somewhere on that line. He likewise finds line C^1D^1 and from it the parallel line CD. The intersection of lines AB and CD indicates his own position O on the map. He then draws a line between points O and X and with his parallel rule finds the reading of line O^1X^1 is 103°. He now proceeds to his fire on a compass reading of 103°. Note, no readings were converted to back sights; only foresights were needed.

If the fire is on the right side of the oriented location, read the right side of the azimuth circle; if on the left side, read the left side of the azimuth circle.

USE OF TYPE SV RADIO INSTALLED IN AUTOMOTIVE EQUIPMENT

E. W. Woods

District Ranger, Clark National Forest
North Central Region

During the spring fire season of 1940–41, two type SV radios were installed in trucks used as initial attack units on fires out of the Fredericktown Ranger Station. One of these was put in a 1940 model Chevrolet ½-ton pickup and the other in a ¾-ton International fire truck.

In order to conserve all of the space possible, a special case was built to hold only the radio chassis and speaker. The glove compartment on both trucks was removed and the radio was installed in its place. The case containing the radio was held in place by means of two galvanized metal strips which fastened with the same screws that originally held the glove compartment. The dimensions of the case were 16x6x4¾ inches. The construction was of plywood reinforced with metal corners and edges.

A 5-foot, 5-conductor battery cord was substituted for the one regularly supplied with the set; this allowed the batteries to be carried under the seat in a specially built wooden box. The battery cable was run under the floor mat and up the inside of the dash to the radio. It was found that the super heavy-duty B-batteries could be used, which resulted in a long period of service without replacement and also a saving in cost over a period of time. Regular 1½-volt telephone dry cells were used for A-batteries.

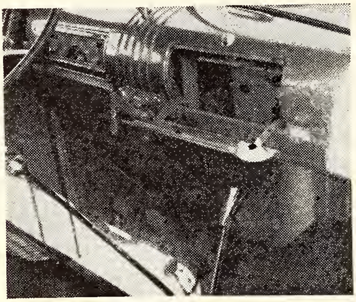
An ordinary telescoping, 7-foot whip aerial was used for the antenna. This was fastened to the right side of the cowl and connected to the set by a short lead-in.

One of these sets has been in operation 7 months and the other 6 months, and neither has ever given a moment's trouble. One truck has traveled over 8,000 miles since the radio was installed and the other about 4,000. Most of the travel has been over very rough roads and under all sorts of conditions. There seems to have been no failure from excessive vibration. The sets did not seem to pick up any excessive engine noise, as conversations are carried on very satisfactorily while the truck is traveling along the road.

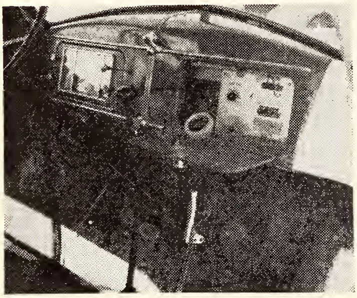
It was found that communication was generally possible with either the ranger station or some lookout tower from any point on the district. The sets were especially useful in communication with airplanes. On several occasions two-way conversation was maintained between the plane and the initial attack crew in one of the radio-equipped trucks. Officers in the plane were thus enabled to direct the crew to the fire with a minimum of travel and also inform the

fire foreman of the fire's behavior, hot places, danger spots, and in other words, have the fire scouted for him when he arrived. The arrangement also has great possibilities in apprehending fire setters, for the plane pilot can occasionally keep the incendiarist in sight and inform the fire crew of his movements.

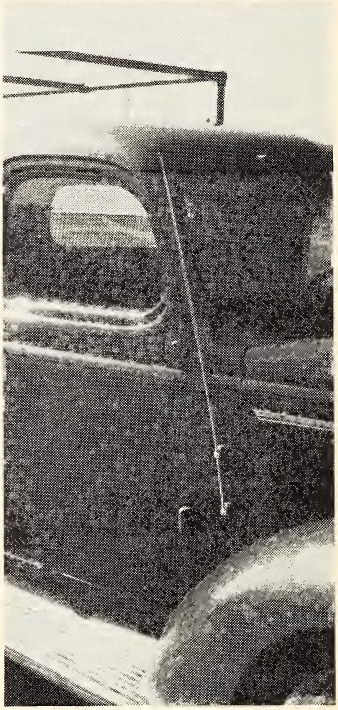
One of the foremen, during the fire season, rigged up a steel fly rod as an aerial on his truck and connected it to an SV set carried on the seat beside him. This worked very well and on two different



SV radio installed in Chevrolet pick-up.



SV radio in International ¾-ton truck.



Aerial for SV radio in Chevrolet pick-up.

occasions was used to receive directions from the airplane on how to get into a fire that was burning in country new to the fire boss.

The installation of two-way radio equipment in our fire trucks has apparently very materially contributed to a decided drop in the size of the average fire on this district. It has also greatly increased the effectiveness of the use of plane by making possible direct communication with the crew going to the fire.

RADIO COMMUNICATION ON THE WASHAKIE NATIONAL FOREST

Roy L. Williams

Forest Supervisor, Washakie National Forest, Region 2, United States Forest Service

Forty-five percent of the Washakie National Forest is wilderness area and much of the remainder carrier lodgepole slash from tie sales. The short-term force of the forest consists of one lookout and one recreation guard. On an area such as this, the use of radio can go far in providing communication flexibility in the back country. What was unusual yesterday is commonplace today.

During the last 3 years, short-wave radios have been used on the Washakie National Forest to enable district rangers to spend a maximum of time in the field, eliminating the necessity of standing by at headquarters during periods of high hazard. Communication has been maintained throughout the fire season over a network of seven stations, which are centered around the Warm Springs Lookout Station. The lookout serves as chief radio operator and the station is connected by telephone with all ranger stations and the supervisor's headquarters.

One of the later sets, SPF 783, is in use at Warm Springs and gave satisfactory service during the entire 1940 season. Daily contacts were maintained with the supervisor's office in Lander, a distance of 80 miles, and with the Wapiti CCC camp on the Shoshone Forest, a distance of 60 miles.

During the peak of the fire season, an SP set was installed at a secondary lookout on Indian Point and hourly contacts were made with Warm Springs. Another SP set was installed at the timber sale ranger's headquarters and scheduled contacts were made daily with the lookout.

Trail crews on both the Absaroka and Wind River Districts were furnished with SP sets and contacts were made morning and night with these crews, except during period when the fire-danger readings were in the high class, when more frequent contacts were made.

The Washakie Forest is very rough with practically no roads. Range administration is the principal activity during the field season, making it necessary for rangers to spend a large percentage of time on long pack trips. Two rangers were equipped with SPF sets and made regular contacts with the lookout station in the morning and at night. During periods of high hazard, noon contacts were made. Such contacts gave the rangers a feeling of security and enabled them to continue trips in the field.

The new SPF sets are very satisfactory and can be sujected to very rough use. They were carried on pack horses throughout the season, and when set up gave no trouble. Contacts were established on sched-

ule except on a few occasions when some of the tubes shook out of the sockets. Also it was found necessary to carry an extra set of batteries with each set.

The greatest difficulty experienced with these sets on field trips was with the long antenna. In timbered areas, it could usually be hung from trees but this took time both in setting up and dismantling, a job which the field men disliked to do, especially at lunch time. Many noon contacts were passed up last year because of the time required to hang up the 150-foot antenna. Where camps were made above timber line, it was difficult to find antenna locations. One end of the antenna was generally attached to a rock in such situations and the other to a peg in the ground. Contacts were established in this manner but not always satisfactorily. It is possible that some form of fishpole antenna might be developed which, when not in use and for packing, could be telescoped together; and when in use could be stuck into the ground and connected to the set.

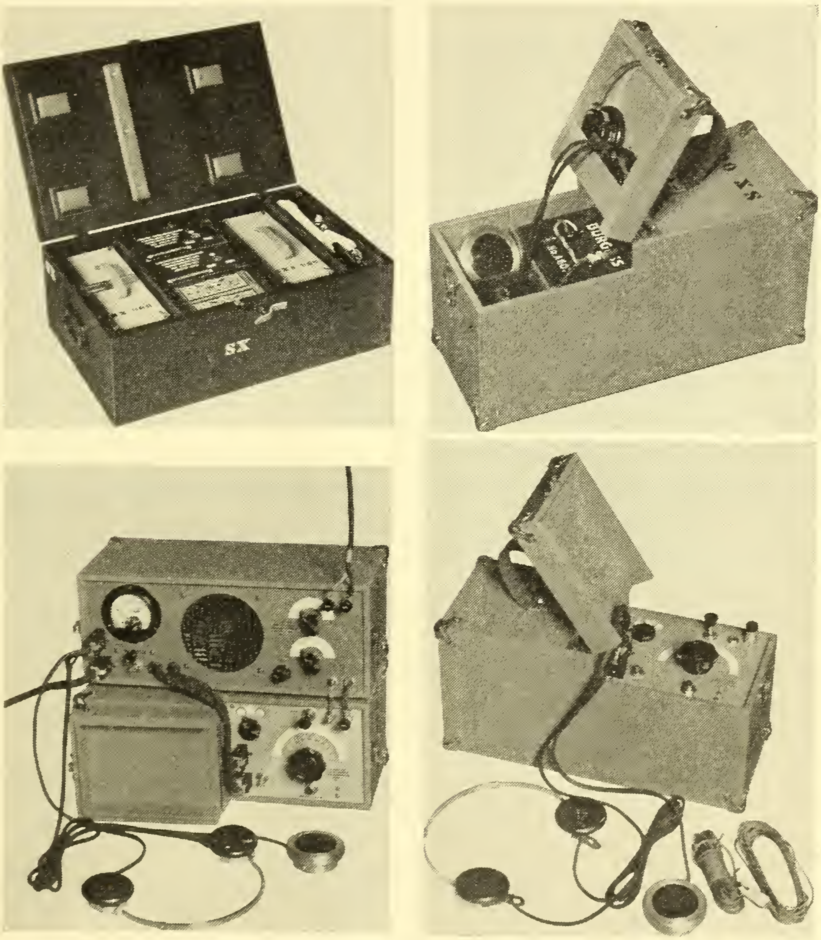
Experience over the 3-year period has clearly demonstrated that the use of radios by field men is practicable on the Washakie and, in fact, is necessary. The rangers have become so dependent upon radios that it is now almost impossible to carry on the work in the field without such equipment. The fact that the Warm Springs Lookout Station is centrally located for a dispatcher set-up adds considerably to the efficiency of the radio-communication system and also has made it unnecessary to employ special dispatchers to handle the radio-communications program.

The Washakie Forest expects to continue and enlarge the radio system and provide trail crews, emergency guards, and other short-term men with additional sets as rapidly as funds permit so that they can carry on and broaden their usual duties during the field season without interruption to stand by during periods of high hazard.

A PUSH BUTTON TUNING PORTABLE RADIO

Radio Equipment Bulletin

The type SX radiophone is a stabilized unit having extreme flexibility in application. The type SX is a portable radiophone with



Type SX radiophone, model A.

self-contained batteries, applicable to uses of scouts, smokechasers, and others requiring extreme portability. The addition of the type

SXA radiophone attachment, which incorporates a loudspeaker, adapts the unit to semiportable service in lookouts, ranger stations, and wherever standby operation is needed. The type SX in the portable form supersedes the type S, and with the attachment supersedes the type SV.

The type SX transmits and receives voice only. The portable unit weighs about 10 pounds, and has a rated working range of about 50 miles over *optical paths*. However, with low antennas and over level terrain, this may be reduced to 3 or 4 miles. A panel switch permits selection of any of three transmitting frequencies, any or all of which may be crystal controlled. The receiver is substantially nonradiating.

The provision for selecting any of three crystal-controlled frequencies adapts the unit for operation in fixed-frequency networks, and permits ready transfer from one network to another. The procedure for establishing communication is far simpler than for types S and SV. A panel pushbutton provides means for setting the receiver on any of the three transmitter frequencies.

Where strictly portable operation is contemplated, the radiophone is normally used without the attachment. The type SXA radiophone attachment is desirable where standby service is needed, since its amplifier and loudspeaker relieve the operator of the necessity of wearing headphones. No additional wiring or mechanical change is required to install the attachment. It is merely necessary to remove the microphone and battery-cable plugs from the radiopohone and insert them into receptacles on the attachment. Short stub cords on the attachment are then plugged into the radiophone receptacles.

A kitbox is normally supplied when the attachment is ordered with the radiophone. This has compartments for storing the radiophone, radiophone attachment, heavy-duty batteries, heavy-duty battery cable, type J antenna, and halyards.

Orders for the type SX should state the desired transmitter frequencies, and which of these are to be crystal controlled. When ordered without the attachment, the type SX radiophone will be supplied with portable batteries, but without the kitbox, unless otherwise specified. Where the companion type SXA attachment is also ordered, the kitbox will be furnished, together with the type J antenna, halyards, and the heavy-duty battery cable. Heavy-duty batteries are not normally supplied, since they add weight to the shipment and are usually available locally.

A MORE "EATABLE" EMERGENCY RATION

M. A. Benedict

Forest Supervisor, Sierra National Forest,
Region 5, U. S. Forest Service

The emergency fire rations used in region 5 have "refueled" many weary fire fighters, but there has been little praise for their "eatability." However, it took a bear that broke into the Sierra Forest's guard station at Placer to convince the Sierra force that a change of diet was needed.

The bear ripped open all sorts of canned foods, beans, and flour, but carefully avoided the roast beef, hash, and brown bread in the emergency ration sacks. The only possible conclusion was that what a bear wouldn't eat wasn't just the right dish for a man. So, thanks to Old Bruin, fire fighters on the Sierra are looking forward to a new menu in their 1941 ration sacks.

A 1-man, 1-day ration has been made up as follows:

Item	*Weight in ounces*	*Cost on bid*
Luncheon meat	12	$0.196
Date-nut bread	16	.188
Grapefruit juice	8	.036
Sliced peaches	9	.045
Beans	16	.074
Raisins	15	.054
Tomato juice	10	.041
Shoestring potatoes	4	.081
		.715
Freight		.015
Total cost per 1-man, 1-day ration		.760

Total gross weight, 7½ pounds.

Also, a 1-man, 1-meal ration has been developed:

Item	*Weight in ounces*	*Cost on bid*
Vienna sausage	4	$0.071
Date-nut bread	8	.094
Tomato juice	10	.041
Grapefruit juice	8	.036
Beans	8	.037
		.279
Freight		.011
Cost of a 10-pound misprint sugar sack		.020
Cost per 1-man, 1-meal ration		.310

Total gross weight, 3½ pounds.

EARLY AIRPLANE SUPPLY IN REGION 6

Glenn E. Mitchell

Wildlife Management, North Pacific Region

The use of airplanes as standard equipment for fighting forest fires has gone a long way since 1926. When one sees the special packaging of "chute loads" and "parachute smoke jumpers" fully equipped to attack remote fires, the contrast is amazing.

Back in 1926 on the Chelan, an airplane of the old Army DeHaviland type was used for reconnaissance. After the Boulder Creek fire was controlled, as I started out to headquarters, some of the boys said, "Be sure to send a plane over with our mail." The cook added, "You had better add a few pounds of butter, too." The mail and butter were dropped by putting them in a large white sugar sack, tied at the end to give as much air resistance as possible. The report was that they got both mail and butter in good shape.

In 1932 the Siskiyou had a large number of lightning and incendiary fires. Five class C's were going at once. The forest was about the most inaccessible in the region at that time, and one fire, the "Red Mountain," was difficult to reach. It was only 12 miles from the end of the road to the top of Red Mountain, but the topography and ground cover is such that distance is a poor indicator of travel time; a pack train required 2 hard days to make a round trip.

Radios were not so good those days as they are now and communication was slow and discouraging. The regional office secured the services of an autogiro in Seattle and sent it down to Grants Pass for reconnaissance. The fires were all near the ocean so the home port was established at Crescent City. Occasionally fog obscured the beach and once the "giro" started for Grants Pass, 90 miles away, to refuel. The pilot was alone and not knowing the country landed where no one ever had before, in an isolated field, deep in a canyon 18 or 20 miles from Grants Pass and 12 miles from a road. The rancher had a little gasoline for use in lamps which was sufficient to take the pilot to Grants Pass. The pilot asked the general direction. Though he never admitted it, he was probably lost as well as short of fuel.

Word came out from Red Mountain that the crew needed lunch foods. We decided to use the "giro." Meats, jam, and bread were tied in large burlap sacks with as much slack as possible, putting probably 25 or 30 pounds in each sack. When we were over the fire camp, the pilot by reducing the speed of the engine, would allow the "giro" to settle down close to the ground and we would heave out the sacks. Two or three such loads were all the pilot would take at a trip. One of the interesting things we belatedly learned on that job was that solid loaves of bread would shatter so they could

not be sliced, but that sliced loaves were seldom damaged. Occasionally a can was broken, but we purposely dropped the sacks on thickets of knobcone pine to break the fall as much as possible.

The supplying of lunch foods by "giro" made it possible to support a larger crew than could have been maintained with the available pack train. It also indicated early the possibilities of such methods of supply.

Another interesting incident occurred when we were out over the ocean. The ship gave an unusual jerk and I thought the pilot was trying to attract my attention as I was in the forward seat. Immediately he started for land and signaled O. K. We landed in a hay field and found a guy wire used to space the fins of the "giro" had broken. When the repairs had been made we took off without any difficulty and returned to the base.

The "giro" was limited as to load and range but it was excellent for detailed vision of the ground as it would hover over a spot for several seconds and it was possible to converse with the men on the ground by short messages.

It was interesting to me to compare the 1932 plane service with that of 1938 on the same forest. During the latter season we were supplying all equipment and rations, including water, to four camps of more than 50 men each and part of the equipment to four more camps. The terrain was exceedingly rough and the dropper could have used a bomb sight to good advantage. Some of the camps were so located that a miss of 100 yards would result in a complete loss, but only a few chute loads were lost on that account. Once a chute load dropped in the fire close to the line. Supplies were so badly needed that two men rushed in to save the food but were successful in salvaging only a part of it.

In those days we dared not think of dropping men on fires. Brains and courage, however, can do much to shape nature to the needs of man.

AIRPLANES VERSUS PACKHORSES

JACK B. HOGAN

Wallowa National Forest, Region 6, U. S. Forest Service

The following contribution to airplane experience bears on the questions raised in the April 1941 issue of FIRE CONTROL NOTES. Securing and analyzing data on all phases of the subject will aid in determining under what conditions airplanes may best be used in fire control.

The Wallowa National Forest has been one of the experimental grounds for dropping supplies and equipment to fire camps from airplanes. Additional experience in this phase of fire suppression was gained during the 1940 season on the Cook Creek fire. Caused by an abandoned campfire this class C fire burned 22 acres. It was located in the bottom of a deep draw along the edge of a stringer of timber leading to the head of the draw, paralleled by slopes covered with bunchgrass, cheatgrass, and various species of brush.

The part of the forest in which Cook Creek fire occurred is approximately 8 miles airline from the location of the Rogersburg fire of 1939, which started in the State of Washington and burned south into Oregon to within a mile of the Wallowa Forest boundary, covering more than 11,000 acres. The area adjacent to the location of the Cook Creek fire is similar to much of that burned over in the Rogersburg blaze.

The horizontal distance from the nearest road to the Cook Creek fire location is about 1¾ miles. The difference in elevation between these points is more than 2,500 feet and the topography is extremely rough. From 2 to 2½ hours were required for a packhorse trip from the base camp on the road to the camp on the fire line.

The base camp was located approximately 50 miles from the Enterprise fire warehouse (Enterprise is the supervisor's headquarters), a distance requiring 2 to 2½ hours' driving time by truck.

Accurate time records were not kept for packing horses or for packaging, preparing for dropping, and loading supplies and equipment transported by airplane. However, statements of forest officers concerned indicate the time required for preparing and loading was about the same for each operation.

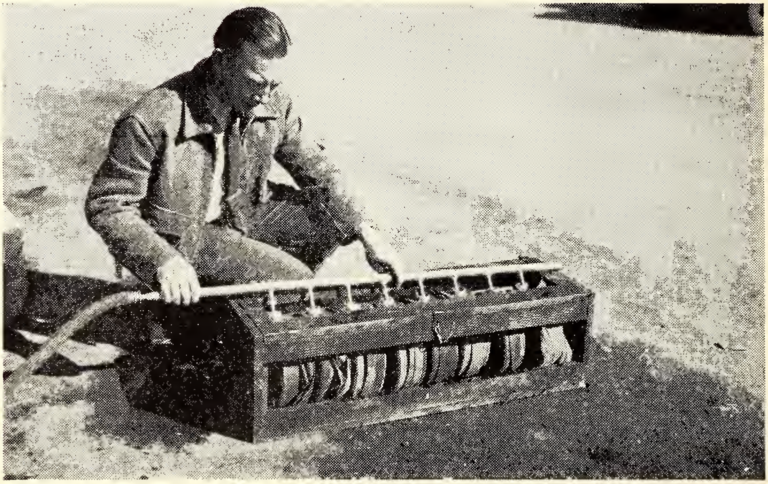
The landing field at Enterprise is 2 miles from the Forest Service warehouse. A Travelair plane, operated by Zimmerly Brothers Air Transport of Lewiston, Idaho, with a capacity of 800 pounds in addition to pilot and dropper, made repeated trips from the Enterprise landing field to the fire and return in 1 hour. For delivery of supplies and equipment from the Enterprise warehouse to the fire, including unloading time, approximately 45 minutes was required by airplane and about 5 hours by pack horse.

The cost per pound for delivery of supplies and equipment to the Cook Creek fire was 5.4 cents by airplane and 2 cents by pack

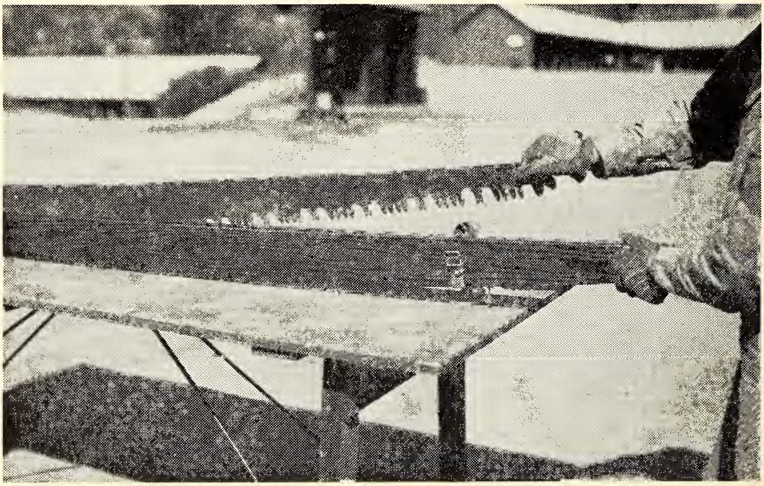
animal. The objective of fire control requires that immediate and thorough action be taken to control fires, mop them up to the point of safety, and then extinguish them wholly or in part in accordance with fire-fighting standards. If airplane transportation is available, its use seems justified on fires in inaccessible locations comparable to that of the Cook Creek fire, and such transportation should be used for supplies and equipment needed until mopping up to the point of safety is completed.

The fact that the Cook Creek fire was confined to 22 acres indicates the effectiveness of the action taken. The favorable outcome may have resulted from the initial attack by four Forest Service employees and nine cowboys, mop-up work done by the 40-man CCC crew, or "an act of God." Probably all the "actions" described, combined with the delivery of food and equipment by airplane, were responsible. Incidentally the campers, who left the campfire burning, were apprehended and satisfactory law-enforcement action was obtained.

Equipment Hints.—Pictures have recently been received of two devices developed on the Sierra National Forest of the California Region which have interest beyond that forest. The canteens of suppression crews are carried in racks of 8. Filling them daily from one faucet apparently proved time consuming so a pipe was rigged with garden hose threads on one end and with 8 outlets welded to the pipe. The 8 canteens can be filled as quickly as one could be previously. No valve is shown in the picture but one could be used if desired.



Multiple spout filler for canteens.



Wooden saw guard.

The other illustration shows a saw guard devised to replace the rubber guards which are no longer being purchased because of the need for rubber in national defense. The saw guard is made of three pieces of plywood by bolting together the two sides and the separator and riveting a web strap with a buckle at each end.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

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VOL. 6 APRIL 1942 NO. 2

FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and technique may flow to and from every worker in the field of forest fire control.

Volume 6 Number 2

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FIRE CONTROL

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The value of this publication will be determined by what Federal, State, and other public Agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

Address DIVISION OF FIRE CONTROL
Forest Service, Washington, D. C.

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THE PRIEST RIVER FIRE MEETING

Kenneth P. Davis

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Research and administrative men in Forest Service fire control met to appraise their technical problems at the Priest River Experimental Forest, Idaho, December 2–6, 1941. Twenty-seven men attended throughout the meeting. From Research were 9 men from the 6 stations carrying on fire research, plus 3 from the Washington office. Administration had 13 men from Regions 1 to 9, and 2 from the Washington office. In addition, Regional Foresters Watts and Kelley sat in on part of the meeting, doing their best, as Watts said, "to add to a healthy state of confusion."

The last general investigative meeting was in 1936, and substantial progress in fire control has been made since. According to Headley's recent report, the annual average acreage of lands within the national forests burned per million acres has dropped from 2,421 in 1930–34 to 1,418 in 1935–39, and the trend is still downward. The once seemingly far distant goal of one-tenth of 1 percent burned annually is rapidly being approached; in fact, it has been exceeded on some forests.

Research has progressed correspondingly. In the last 5 years, fire danger meters have developed from a somewhat newfangled device to a mainstay of the fire-control organization in most regions. Discussion of fire meters now centers around what kind of a meter and how to build a better one rather than why a meter. Thorough studies of visibility have helped round out a working knowledge of fire detection; a good start has been made on more fundamental studies of fire behavior to give the fire dispatcher and boss a better guide for action; and much progress has been made in determining fire effects to give a basis for controlled use and evaluation of damage. A region-by-region analysis of investigative needs in fire control was completed early in 1941. The time was ripe for a constructive over-all appraisal of the direction, emphasis, and organization of the fire-research program and the formulation insofar as feasible and desirable of a coordinated national program.

At the meeting fire-investigative needs were divided into 5 topics: Fire economics, prevention, effects and use, behavior, and organization and management. A committee for each topic was appointed in advance and made responsible for a well-rounded presentation and summary of the sense of the meeting. Each topic was opened by 3 to 4 more or less set papers by committee members and followed by open discussion, with the committee acting as an "Information Please" panel. Following topic presentations and discussions, the respective committees went into a huddle and produced recommendations for a final round of general consideration and summary.

The interest in and emphasis on the economics of fire control were high lights of the meeting. It was generally agreed that much hard-headed appraisal and study were needed of values at stake and liable to damage in relation to protection costs, to guide fire-control effort effectively and indicate its proper intensity.

Some background may help in orienting the present situation. Economic problems in fire control have long been recognized. But in the past, with control rather obviously inadequate, there was no great need for thoroughgoing economic analysis. The ratio of benefit to cost was strongly favorable. This perhaps explains in part why Sparhawk's comprehensive analysis of liability ratings nearly 20 years ago [1] and other past studies and proposed programs for economic research have not been aggressively followed. A contributing factor was lack of statistics on which to base sound analysis.

The situation now is somewhat different. Specifically considering the national forests, a degree of control is now being achieved on some areas—but not all—that even 10 years ago seemed a far-off dream. Retraction of CCC and other emergency aids responsible for much of this advance in control effectiveness has developed keen pressure to define how much protection is justifiable and how much it costs. Intermixed with this is increasing consciousness of the economic ramifications of timber losses and of the existence of many forest values other than timber. These factors have combined to make questions of achieving proper balance and intensity in fire control of immediate importance. So, while interest in fire economics is not new, there is evidence of considerable more wallop behind it to do something.

The committee recommended as a first step that investigative work be started at the national level to identify and develop methods of measuring the direct and indirect effects of fire on all forest resources in terms of dollars, so far as possible, but not overlooking values not now measurable in dollars. Also, to determine the cost of various intensities of protection and the probabilities of losses, and on the basis of this information to indicate justifiable expenditures for fire control. A big job and, it was soberly realized, one that would take continuing effort. Case studies could probably be employed that would yield useful answers to particular problems and also contribute toward a body of information generally applicable. Wide regional differences in economic problems were recognized and regional studies were encouraged, though it was believed they should be supervised at the national level to promote reasonable uniformity and avoid unnecessary duplication. A two-man project was recommended as a minimum beginning.

Another recommended extension into a new field of research was in fire prevention. Long recognized and wrestled with as a serious problem, it has not received much systematic research attention. For fire prevention effort to be effective, the underlying reasons why and how people start fires must be known, and convincing counter reasons must be advanced and put in such terms and form that they will reach

[1] Sparhawk, W. N. The Use of Liability Ratings in Planning Forest Fire Protection. Jour. Agr. Research 30 (8): 693–762, 1925.

(Continued on page 84)

REVIEW OF PROBLEMS AND ACCOMPLISHMENTS IN FIRE CONTROL AND FIRE RESEARCH

H. T. Gisborne

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This topic was assigned to the author at the recent fire research meeting at Priest River Experimental Forest, Idaho. When asked to permit publication of his paper in Fire Control Notes, he replied that he had no notion that his paper was an historical opus of any kind. "It was prepared to be read to an in-Service, friendly group * * *. It was intended to be a mustard-plaster, counter-irritant, spiced-up cocktail." It doubtless brought the meeting up on its mental toes right at the start. But, in addition, it is a valuable beginning of a facinating and important chronicle—the saga of fire control for the last 35 years.

As the author expects, there will be disagreement with regard to some of his "milestones of progress." If, however, his stimulating article impels other men to submit article making corrections or additions, or questioning his emphasis on some "milestones," the foundation will be laid for a history of an amazing development in the conservation of natural resources of the United States. A perspective derived from some knowledge of our "milestones" is indispensable to our thinking now and in future years.

Selecting a Point of View

Whoever laid out the program for this meeting utilized one device which is recognized by philosophers and successful writers as essential to the productive development of discussion. At Spokane, a month ago. Dr. Carl F. Taeusch, of the Bureau of Agricultural Economics, told us that for common understanding of any problem it is essential that we first establish the "framework of ideas within which we are trying to work out the problem." Walter B. Pitkin stresses the same point when he says: "The next task is to take some position toward the subject you propose to discuss * * *. When you take a position toward a field of fact or fantasy, you do something strangely like the choosing of a vantage point from which you view a valley * * *. Point of view and perspective determine the special arrangement and design of the entire panorama. Any valley may be seen from a thousand outlooks. Always the same valley, it presents itself in a thousand manners according to the outlook."

Our present program makers obviously agreed with these authorities when they set up Topic 1 as a review of problems and accomplishments in fire control and fire research. They recognized the need of getting together and being sure that we are all looking at the same valley, not mistaking some of the minor gulches for the main valley, before we plunge into the examination of specific phases of the problem, each of which is minor to the whole. They apparently agreed

with Dr. Morris L. Cooke who states, under the title of "On Total Conservation": "Increasingly in human affairs—material, intellectual, and even spiritual—the effort is made to see things whole."

Personally, I welcome the oportunity to tackle this topic because I am convinced that failure in recent years to look at the whole problem first, and its parts second, has caused a large part of what we now call the fire problem. For the past 20 to 25 years, we have been so engrossed with certain exceptionally pressing phases of the fire problem that at times we have almost lost our perspective. I believe that I can demonstrate this to you. In the process I hope that I can establish a common vantage point and thereby reveal the true size and complex topography of our "valley."

To do this, I propose to go back to the beginning of Nation-wide fire control and come down the 35-year road, citing what I have selected as the outstanding accomplishments. In this selection I have had the help of Major Kelley, Axel Lindh, C. K. McHarg, Roy Phillips, W. W. White, and Clarence Sutliff. I take full responsibility, however, for all omissions of events which you may think should have been included in this historical series.

One basic presupposition seems to be essential, and to demand full agreement and understanding before we proceed. This is the premise that all of our experiment station divisions of fire research have just one justification for existence, just one function, just one objective. That is: To aid the present and future administrators of fire control, Federal, State, and private. We are not doing research for research's sake. We have a definite, decidedly practical goal, and it is still the basic, over-all goal that Graves stated in 1910: "The first measure necessary for the successful practice of forestry is protection from forest fires." Fire research is therefore intended to serve as directly as possible the fire-control men who must first be successful before any of the other arts or artists of forestry can function with safety.

There is one other and perhaps even more basis presupposition that should be raised here. I do not expect that we could get unanimous agreement on it, but it is a condition or factor which certainly should influence your reaction to my selections of the significant facts in the history of fire control. Furthermore, it is a basic factor in determining your reaction to much of the discussion of project program that will follow. It is, in my opinion, the biggest, the most overshadowing, the most all-permeating feature of our fire problem. It is, briefly: Does fire control have to be able to demonstrate with data that its expenditures, in toto or in part, will pay dividends in dollars of increased revenue?

Mileposts of Progress

In venturing to select and designate certain events as mileposts of progress, I realize now, better than I did when I started, the difficulty of the task. Probably no one will agree with all of my selections. But in this game it is dealer's choice and anyone can deal who is willing to write. My own major criterion has been whether or not the event was of national and lasting significance in fire control,

Federal, State, or private. In some cases I have used the first proposal or broaching of an idea if it "took." In some cases the original idea failed to take, or to become nationally effective, until clarified, amplified, or given the right push by some individual. In those cases I used the push that put it over. In a few cases there has been real progress along broad lines, but I have not been able to name the event or date it. I have also probably overlooked some deserving events.

I have tried here to distinguish three types of events: (1) Progress toward better objectives in fire control, (2) better methods used in pursuing the objectives, and (3) better finances permitting the use of better methods. My reasons for selecting these particular events are as follows:

1904. The creation of a widespread framework of forest reserves in 1904, 1905, 1906, and 1907.

Here was the real beginning of all future Nation-wide problems in fire-control objectives, methods, and finance. All previous problems had been relatively local. All State and private major problems of fire control have likewise appeared since the Federal Government began to practice forestry on a national scale. Hence, although Sargent compiled the first fire statistics in 1880, the active history of fire control seems to me to commence in 1904.

1905. In 1905 there was born the first cooperative agreement and work plan between private and State timber protective agencies. This move proved to be so profitable and so beneficial that the formal cooperative protection movement spread rapidly, first throughout the Northwest and subsequently throughout the Nation. This first cooperative association greatly improved both the objectives and the costs of State and private protection. It was so beneficial that similar "cooperation" has even been forced by law in many States, beginning with the Oregon compulsory patrol law of 1913.

1906. The Use Book for 1906 was a definite milepost in bringing all of our major problems of objectives, methods, and finance into focus in terms of the job ahead. These problems are all evident in one short sentence in that book. "At the beginning of the summer season, or before March 15, each supervisor will recommend to the forester the number of men needed adequately to protect his reserve, the rate each should be paid, and the number of months each should serve." There, in one pregnant sentence, are all of our problems—beginning, ending, and degree of fire danger, manpower placement, what constitutes "adequate" protection, the problem of temporary employees, and finances—the wherewithal with which to do everything. Even Mr. Headley's pet problem was there, in the next sentence, reading: "After consideration of these recommendations the forester will fix the number for the full summer force of each reserve, and this allotment will be final." As Gowen and Headley will probably be willing to testify, the forester's office is still "considering" these recommendations and still trying to make allotments that will be "final." Hence, I believe that "The Use Book" of 1906 constitutes a distinct milestone along the road of fire control.

1909. The formation in 1909 of the Northwest Forest Protection and Conservation Association was more of a national milestone of progress than many of you may think. This organization soon became the Western Forestry and Conservation Association and under the

exceptionally aggressive leadership of E. T. Allen, the steady guiding hand of C. S. Chapman, and the farsightedness of Geo. S. Long, it had a Nation-wide influence for more than 25 years. It was especially helpful on Federal appropriations for fire control, fire research, and fire-weather forecasting. It exerted and still exerts an extremely beneficial influence on many State legislatures for the improvement of fire laws, brush disposal requirements, and other objectives. It has contributed steadily to the improvement of methods of fire control, especially on State and private land, through its several editions of the seven chapters of "The Western Fire Fighters' Manual." This text on fire control is probably used in every forestry school in the country. If not, it should be.

1910 (*a*). A milepost contributed by a Chief Forester of the United State. If any man here has not read Forest Service Bulletin No. 82, "Protection of Forests From Fire" by H. S. Graves, he should take time—make time—to do it. There you will find such a keen and clear analysis of the fire problem that, although it was published in 1910, many of its statements have not yet been improved upon.

For instance, if you think that methods of fighting fire, crew organization problems, skill in sizing up and attacking fires, are recent discoveries or new problems, listen this: "The following are of first importance: (1) Quick arrival at the fire; (2) an adequate force; (3) proper equipment; (4) a thorough organization of the fighting crew; and (5) skill in attacking and fighting fires." What factors have we added to that list in the past 30 years since Graves saw these phases of the problem and described them so clearly? While many old-timers have probably now forgotten this bulletin, many later events indicate that such subsequent progress began right here.

1910 (*b*). I may be wrong in erecting a milepost of progress to the great Idaho fires of 1910, but I am told that before they occurred public interest in forestry and the Forest Service was almost non-existent. The dramatic incidents and loss of lives in those fires made newspaper headlines all over the country and "the people" were awakened to two things. First, that timber wealth was burning up; second, that there was a Federal organization trying its best to protect that wealth. These fires probably were the greatest object lesson in forestry that ever occurred, anywhere. A marked upswing in public interest and in funds for fire control was evident immediately after the 1910 fires.

1911 (*a*). The first forest-fire deficiency appropriation in 1911 was certainly a milepost of progress. Some of you may not know that in 1910 several supervisors in Region 1 furloughed all of their unmarried rangers for one month in order to acquire the funds to pay fire-fighting bills of the previous summer.

This situation shows clearly the distinctivness of finances as a separate phase of the fire problem, and reveals the great and serious weakness in that phase existing up through 1910. The provision in 1911 of EFFF, emergency fire-fighting funds, more commonly known as FF, remedied this weakness.

Most unfortunately somebody made this godsend of 1911 into a Damocles sword and has been dangling it over our heads ever since. Looking back at its origin it does not seem conceivable that Congress could possibly return to the fire-financing methods of 1910, forcing furloughs to pay fire-fighting bills.

1911 (*b*). While the Weeks Law of 1911 was primarily aimed at the acquisition and protection of the headwaters of navigable streams, and hence was a milepost in objectives, it also appropriated Federal funds for the first time for fire control in cooperation with the States. It was therefore the forerunner of the monumental and highly effective Clarke-McNary Act that followed 13 years later. All the old-timers tell me that the Weeks Law was a distinct milepost of progress.

1912 (*a*). "The National Forest Manual,' issued in some six or more sections, 1911 to 1913, contained in the volume on "Protection" the first detailed break-down of the fire problem which I have been able to find. There is not time here even to list all the features separately recognized. "The Fire Plan" was named, however, and this was clearly the forerunner of DuBois' "Systematics for California," which followed 2 years later, and for Hornby's highly detailed integrations which followed 12 years after that.

Firebreaks were given great emphasis: in fact, here seems to have been the origin of a fire-phobia which 30 years have not entirely eliminated. Permanent lookouts were indicated as possibly desirable as follows: "Main lookouts are those from which an exceptionally large territory can be seen and where *it might pay* to keep a permanent lookout." The same year that this Manual was distributed, Forest Service Bulletin No. 113 appeared with photographs of permanent lookout towers and houses already in actual use on what was then the Arkansas National Forest.

This Manual of 1912 also took one definite step ahead in objectives when the statement was included: "Practically all of the resources of the national forests are subject to severe injury, or even to entire destruction by fire. Besides the direct damage which fire may do to merchantable timber, to the forage crop, and to watershed cover * * *." For the first time that I can find, "the forage crop" is included in addition to commercial timber and the old stand-by—watershed cover. Here for the first time was an objective definitely broader than "timber alone for dollars alone."

Here also was the real origin of fire prevention research, in the statement: "Since the best way to stop fires is to prevent them, a fire plan must include a careful study of prevention methods." Note that they said, "Prevention methods." I believe you will all agree that we were a long, long time getting past the mere listing of prevention cases and concentrating on the study of prevention methods. There is a vast difference.

Here I would like to digress for one-half minute on the subject of cases versus methods. I have attended quite a few fire meetings, and at most of them I have been struck by the time spent in attempting to solve cases, with so little effort intentionally directed to draw from those cases either methods or principles. A lot of us here today were present at the Washington fire meeting in January and February 1939. My notes for one national meeting contain this statement: "If there has been a single feature of this meeting that has been conspicuous by its absence, it is the phrase: '*There* is a good method, there is a good principle, which all regions should be able to follow or apply.' " Twenty years ago Howard Flint wrote, in a comment on Sparhawk's liability rating: "Why not stick to a *method* that is

fundamentally sound, using figures that are admittedly arbitrary?" I think that Flint hit the nail on the head. I certainly believe that we, here at Priest River in 1941, should keep our eyes open for methods and avoid quibbling over the split-hair accuracy of minor figures or cases that are, perhaps, being used in an unsound method.

1912 (*b*). Daniel W. Adams' "Methods and Apparatus for the Prevention and Control of Forest Fires," Bulletin No. 113, published in 1912, is so clearly the forerunner of both the Fire Control Equipment Handbook and the various fireman's guides and fire-suppression handbooks, that were to follow 20 years later, that it certainly rates a monument. Yet I will venture the guess that not more than two men here ever heard of D. W. Adams or have any recollection of this bulletin. But if you doubt that this was a "first" and should be recognized as such, look at the drawing, in figure 8, showing where to locate a fire line on a ridge and compare it with the drawing for problem 6, page 21, in the Region 5 Fire Control Handbook issued in 1937; or problem 1, page 88, of the Region 1 Fireman's Guide issued in 1940; or Bob Monro's figure 4 in his article (Fire Suppression) in the October 1940 Fire Control Notes. That old drawing of 1912 shows not only the best fireline location but also the wind current involved, just as well as many of the similar attempts 28 years later.

As for equipment, if you think the Los Padres shield for a flame thrower, illustrated in the July 1941 issue of Fire Control Notes,[1] is something new, take a look at figure 2 of plate III of Bulletin 113 published 29 years earlier. For chemicals on the fire line see figure 2 of that same bulletin. For a quick get-away with water tanks on a pack horse, see figure 3 of plate IV. For railroad tank cars, see figures 3, 4, and 5. For something really new, see the logging system suited to better fire control, outlined by figures 6 and 7.

Incidentally, this pioneer work in fire control in Arkansas seems to have borne fruit. Dean Walter Mulford recently stated that "Arkansas, which has 15 million acres of active forest lands, is probably the foremost State in the United States as regards forestry matters." I believe that we here should salute D. W. Adams and the Arkansas National Forests. They were so far ahead of us in some respects that we haven't caught up yet, but if we are not careful we may include in our research program a project or two aimed at features of the fire problem that were pretty well thought out as much as 30 years ago.

1914. 1914, Region 5 tried to scoop the country and keep all good things to themselves, but they were unsuccessful. Coert DuBois' publication, "Systematic Fire Protection in the California Forests," an unnumbered item is not labeled as either bulletin or circular and is marked, "Not for public distribution," was very definitely a milepost in progressive thinking on a national scale, even though the Californians did try to keep it exclusively to themselves. I read that bulletin from cover to cover several times when I was a lookout in 1915. It was all new to me then. Every time I read it now I still find something that is new and useful.

If you will read DuBois you will find that he actually pointed the way for nearly everything that Hornby and I ever did, when he said:

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[1] A Portable Flame Thrower, by Neil L. Perkins.

"A way must be devised of reducing all of these factors (inflammability, season, risk, controllability, liability, and safety) to concrete terms, so that any forest area, after careful study, can be given a rating which will convey to our minds something in the nature of an exact measure of its total fire danger." The expression "class 5.8 danger in a high-high fuel type" does that for Region 1 men today, for any instant and spot, with one exception—"liability" or values are out. Hornby wanted to include those in his "total danger rating" and they were in his first formula, but the 10 a. m. policy came along about then and under it "values are out." So Hornby left them out, to all ostensible purposes, although he fully agreed with DuBois.

Someday we will go the rest of the way for Coert DuBois and put those "liabilities" or values back into the prominent place they deserve, but there is one small matter which must be settled first, the subject of "objectives in fire control." When we clarify that the road will be open again.

1916. It may have been a coincidence, but if so it was a monumental one, when in 1916 Silcox first proposed the one-tenth of 1 percent objective of fire control and about the same time Headley proposed the "least cost plus damage" or "economic" objective. To me, the flat "tenth of 1 percent" was an expedient, but a little bit more sound than the 10 a. m. policy which was to come 19 years later. To me, Headley's theory was and is fundamentally the soundest ever proposed. It has its difficulties, but if we can ever do with it, as DuBois said we must do with danger ratings, "devise a way of reducing all of these factors to concrete terms," we can make that economic theory work. When we do that we will have *applied economics*.

1919. Although there is some evidence to indicate that the Canadians were ahead of us in the use of airplanes in fire control, this phase was not reached until 1924 or 1925. Long before that Howard Flint was investigating lighter-than-air craft and by 1920 the United States Army had become interested. The latter is witnessed by Erle Kauffman who, in an article in the April 1930 issue of American Forests, quotes an army officer as follows: "The day will come when large numbers of men and equipment will be carried by airship to the scene of a forest fire, both men and equipment dropped by parachute, while the airship will rain down fire extinguishing chemicals from above." From this use of the term "airship" it appears that the Army officer was, like Flint, thinking primarily of dirigibles.

The earliest printed record of Flint's interest, which I can find, is in an issue of the Forest Patrolman (Western Forestry and Conservation Association), which quotes Major Kelley, then fire inspector out of the Washington office, as follows: "H. R. Flint, fire chief in District 1, holds credit as the first forest officer to recognize the possibility of real value in the dirigible as a vehicle for transporting fire crews and supplies, and as a means of effective patrol and detection service. In the fall of 1919 Flint corresponded with a concern in the East about the use of a "lighter-than-air machine." Flint, himself, in the December 7, 1931, issue of the Northern Region News, says that airplanes were first used on fire-control work in this region in 1925. Possibly other regions antedated this.

There are three features of this development well worth noting. First, the long, slow, uphill drag indicated by part of Flint's "News" note: "In the seven seasons since that time, backed up by a little real support, a great deal of discouragement, and some ridicule, I have seen the airplane slowly taking a definite place in our work. It has come to stay." Second, an entirely unforeseen value of this new departure almost usurped the place of the original idea. Photographic mapping, pioneered in 1925 by Flint, Jim Yule, and T. W. Norcross, almost stole the show and for several years was more significant nationally than was the fire-control idea. Third, whereas Flint's original idea was aviation by use of blimps, that has not yet come to pass. But the blimp idea obviously led to airplanes, and it is not at all inconceivable that the latest development in airplane use—parachuting men and supplies—may later lead back to the blimps.

1920. I believe that all fire chiefs, fire bosses, and rangers will agree that when Orin Bradeen began in 1920 to centralize the purchasing, packaging, and delivery of fire-fighting food, tools, and other equipment he removed one of the greatest headaches of previous fire control and made the future job both more efficient and less costly. Bradeen erected a milepost from which we have forged ahead, still under his leadership, probably to as near perfection as in any phase of our problem.

1921. Radio, like airplanes, also opened a new epoch and while the Radio Laboratory of the Forest Service has made steady progress, credit for the milepost should go to R. B. Adams who first made radio actually work on a going fire in 1921 and to Dwight Beatty, who, 6 or 7 years later, produced the first truly Forest Service sending and receiving set.

1922. Sometime in the early 1920's, a new idea began to be practiced which has since swept the country and become standard practice in all Forest Service regions. This is organized training. While it began as general administrative training, the value of this procedure in fire control was soon appreciated, and fire-training schools and correspondence courses are now recognized as indispensable to the attainment of adequate fire control. The one man who deserves all the credit for this milepost of progress is Peter Keplinger. His full contribution amounted to much more than the first idea, for he, like Bradeen, stayed with it and developed the method, showing all of us how to use it.

1923 (*a*). Up to 1923 I cannot find a single event produced by research that should be called a milepost of national progress in fire control. Clapp's first working plan for fire research, written about 1916, and the research work of Sparhawk, Show, Larsen, Hofmann, and Osborne from 1916 onward would rate a tremendous monument in the history of fire research alone, but fire research is only one means to an end and here we are discussing all means of progress toward the big END.

Publication of the relative humidity theory in 1923 by J. V. Hofmann and W. B. Osborne seems to me to be the first contribution by research which was of Nation-wide signifiance. The "relative humidity" idea literally and actually swept the country. For a while it appeared to be the total and final answer to the 1916 Work-

ing Plan request for "some simple, single index" of fire danger. For certain fuels and fuel types it is still the simplest and best.

There is one feature of this milepost which should be of special interest to this Priest River assembly of fire-control and fire-research men. While "J. V." (Hoffmann) was an experiment station director engaged in full-time research, "Bush" Osborne was chief of fire control in this region, and an administrator. But there was no "fence" here between research and administration, and this happy combination of a researcher and an administrator proved to be highly efficient. Bevier Show, then a full-time researcher, and Ed Kotok, fire chief, like Osborne, had also joined forces about that same time, and the world knows how productive that was.

To me the milepost to relative humidity in 1923 is therefore a monument not only to the first simple index of fire danger, but it is also a symbol of the great value of combining the efforts of the man experienced in practical problems and the man trained in the methods of solving problems. It is a known fact that nearly all kinds of engines operate best with a balance wheel or governor.

1923 (*b*). When Show and Kotok, in 1923, distinguished between the "economic" and the "minimum damage" theories, I believe that they erected a milepost which should have accelerated future progress more than many of their later contributions. Unfortunately, that particular feature of their "analytical study" did not "take" in the sense of inoculating us against the danger in the economic theory.

By their own words, on page 59 of Circular 243, Show and Kotok demonstrate that even while proposing the minimum damage theory, they also favored the hypothesis of least cost plus damage. For they state, in their summary: "Successful protection is reached at the point where the cost of prevention, suppression, and damage is a minimum." Hence, "minimum damage' 'was offered not in contradiction of the records from all over the country, Sparhawk was not attempting to clearly evident when they state, on page 4, that their main objection to the economic theory is that it will not work when too much emphasis is given to holding down the costs of prevention and presuppression.

1924 (*a*). The Clarke-McNary Act of 1924 hardly needs any justification as a milepost of national progress. It recognized for the first time the Federal interest, hence responsibility, in fire control on private as well as State forest lands, and it provided those highly essential funds, without which the best ideas and interests lie dormant.

The Clarke-McNary Law did one other thing that is significant. It revived a phrase from the Use Book of 1906— "to adequately protect." That was the stated objective of fire control on the national forests in 1906. It is repeated as the objective of Federal, State, and private cooperative fire protection under the Clarke-McNary Law in 1924. Here are some simple words coming down through history. But, I ask you in 1941: "What do those words mean?" "To adequately protect?" "Provide adequate protection?" Do we even yet, in 1941, know just what those words mean? I am quite sure that *we do not know what we are talking about when we put these words into our Federal laws and fire-control manuals.*

1924 (*b*). The first written agreements between the Weather Bureau and the Forest Service providing for "fire-weather warnings"

were dated August 11, 1916, and March 12, 1917. They provided for measurements of only wind velocity form the forest stations, although the forecast was to cover other meteorological elements. As late as 1923, however, these forecasts, when furnished, were of such doubtful value that I cannot rate either or both of the old first agreements as a milepost of progress.

In about 1924, however, a meeting of Weather Bureau and forest protective agencies was called by the Western Forestry and Conservation Association. At Portland, Oreg., and at the Wind River Experiment Station methods of measurement and types of forecasts were thoroughly discussed. Out of this came the first congressional appropriation of funds specifically for fire-weather forecasting. I believe that that meeting in 1924 rates the milepost.

1925. Everyone here is aware of the vital and extremely practical problem of allotting fire-control funds. Regional fire chiefs probably appreciate it most keenly. It cuts them most. Headley and Gowen undoubtedly know more about it than anyone else in the world. How many of you knew that Sparhawk worked on this particular problem from 1915 to 1921 and wrote a bulletin on it, that was published in 1925? [2]

In his tremendous compilation and analysis of Forest Service fire records from all over the country, Sparhawk was not attempting to tell Operation or anyone how much money should be allotted that year or the next year to each region, forest, and ranger district. He was hunting for a method by which that could be done. He says so, very specifically, in the third sentence of his report.

But even more than this, Sparhawk was hunting for an over-all justification for fire-control expenses. He was trying to answer that extremely basic question: "What is the cost of adequate protection?" In the light of our admitted ignorance today, just pause a moment to consider Sparhawk's task: "What is the cost we can justify to do a job which we cannot define, using many elements which cannot be measured?" Then look at the miserable, incomplete, inaccurate fire reports which he had to work with! No; Bill Sparhawk was not born too soon, and he was not tackling an impossible task. It is not his fault that we are not all thoroughly familiar with his report. It is ours. We have so lost touch with our own literature and so lost our perspective of the basic features of our job, that we now piddle around with fire danger meters and argue whether we should use 5 classes or 7 classes or 100 classes, while Bill Sparhawk's clear vision of the really basic problem gathers dust on our bookselves.

As evidence of Sparhawk's attitude toward the economic theory, you will find as figure 1 in his report a diagram illustrating the effect of the law of diminishing returns. This last summer Mr. Headley was carrying around and distributing to all willing listeners a very similar diagram. From 1925 to 1941 is 16 years. This feature of the problem must be something.

As another bit of evidence of Sparhawk's vision and the effect of his work on later efforts, you will find in his report published in 1925 and in a memorandum written after he had completed the manuscript in March 1922, the words, "hour control." Show and Kotok

[2] The Use of Liability Ratings in Planning Forest Fire Protection. Jour. Agr. Research 30 (8) : 693–762, 1925.

picked up this ball and kept it moving in their 1930 "Determination of Hour Control," but they rather dragged their feet on the subject of the justifiable cost of any particular hour control. What is the operational function of hour control anyway? It is to get adequate protection. And what is "adequate protection"? Does anyone know? Don't we need to know?

Sparhawk knew that we have to know, for on page 694 of his report he listed, for the first time to my knowledge, all the kinds of values of forest resources which justify protection. No one has since added *anything* to that list of timber, including mature timber, young growth, the forest capital, and soil productivity; forage for livestock; regulation of stream flow and the prevention of erosion and floods; game resources; recreational use; improvements; and other occupancy values. That list is a true masterpiece of perception. Note, for instance, the inclusion of "the forest capital." When the silviculturists get a working circle into managed age classes, it is obvious that fire wiping out one or two particular classes would do damage far exceeding the maturity value of those particular trees discounted to date. The whole working circle would be thrown seriously out of orderly future progression, and there is a form of loss that is still far ahead of us in 1941. Sparhawk saw it, and named it, in 1925! Research program makers of 1941 can well go back and begin at the 1925 milepost in many respects.

1926. This milepost, "A National Program of Forest Research," by Earle H. Clapp, is too well known and so well appreciated that it needs no explanation. There are certain features of the forest protection section, however, which I should like to emphasize.

First, protection from fire, fungi, and insects are grouped and tied together so closely here that every time I read these three sections over again I wonder why the Forest Service has a solitary division of fire control when the job, on the ground, could be so much more efficiently handled by a division of forest protection. Here may lie one of the most effective methods of solving the problem of the temporary employee or—keeping a trained organization.

Second, in 1925 Sparhawk came out and named all of the many reasons for fire control, of which commercial timber was only one. A year later, Mr. Clapp implied, by his words "forest management" and "to grow timber," that timber alone for dollars alone is our major and perhaps sole justification.

Third, that Mr. Clapp subscribed to the economic theory is shown by his statement: "Possibly they (foresters) should also be able to set limits beyond which expenditures for protection are not justifiable, that is, the determination of that point where the law of diminishing returns becomes effective." In his next sentence he opened the door to the ultimate answer when he said: "But if used at all, these limits should be set upon very comprehensive rather than narrow considerations." As will be brought out later, the dollar value of destructible resources is not the sole criterion of damage and a much more comprehensive basis, as Mr. Clapp called it, is absolutely essential.

Fourth, under "Protection Standards," Mr. Clapp stated 15 years ago: "Satisfactory timber crops cannot be grown unless certain definite standards or objectives of protection are attained." And he

continued: "Those standards must be definitely determined." And: "This is a task best attempted by research methods."

Let's keep this milepost in mind when we get to our 1941 research program.

1928 (*a*). The McSweeney-McNary Act of 1928 is perhaps merely a result of the 1926 national program, but it is well to point out one difference. The "program" was an idea, a plan for a "functional operation." It could not function, however, without finances. The McSweeney-McNary Act liberated these essential dollars, like putting water into an irrigation ditch.

A lot of fine work had gone into building the ditch and laying out the orchard, but until some water was turned into the ditch the orchard could be neither planted nor irrigated. The McSweeney-McNary Act did that.

Here, again, when we come to our fire-research program, let's remember our history. We here at Priest River are merely extending that same ditch and laying out some more orchard. And that's all. The other half of the job still remains to be done. Somebody has the specific job of diverting water into our ditch. Whose job is that anyway? Unless that job is specifically assigned, and a McSweeney-McNary Act puts golden water into our ditch, our job here at Priest River will join Sparhawk's fine work on the bookshelves.

1928 (*b*). Another milestone of progress was erected in 1928, or thereabouts, which should be credited specifically to the Chief of our Division of Engineering, T. W. Norcross. The Norcross-Grefe report was not published until 1931, but apparently, "Transportation Planning" was well under way as early as 1928.

When Norcross saw the opportunity, planned a systematic attack, and rang the bell with his "Transportation Planning Methods," he gave all future forest researchers and administrators a well designed tool. In my opinion that is a major contribution.

1930 (*a*). Although Sparhawk may have originated the "hour control" idea in fire control in the early 1920's, and Norcross was designing transportation planning to meet hour-control standards in the middle twenties, still there is no doubt that Show and Kotok made a milestone of that concept when, in 1930, they published Technical Bulletin No. 209, "The Determination of Hour Control for Adequate Fire Protection in the Major Cover Types of the California Pine Region." This popularized the idea and the term sufficiently to produce action in many parts of the country.

In this bulletin, Show and Kotok also added to all previous concepts of "adequate protection" when they went one step beyond Silcox by setting "an annual average of 0.2 percent for the commercial and potential timber types and at 0.5 percent for the nontimbered types" as the criteria of adequate protection in their region. Here was recognition of a "variable standard" varying according to economic demands. There were many other outstanding features of this particular publication, but none, to my mind, either in this bulletin or in their earlier "Role of Fire" and "Cover Type" bulletins, which so strongly influenced national ideas and action as this variable standard.

1930 (*b*). The milepost erected by the District Foresters' Washington meeting in 1930 seems actually to have been primarily and

largely a Nation-wide application of the "variable standard" originated by Show and Kotok.

In view of all previous statements of objectives of fire control, it is well to note here how the district foresters affirmed the past basis of damage as a criterion, as follows: "Damage from fires to forest values varies considerably in the different forest types and the objectives in fire control must be based mainly upon consideration of these variations in damage." The fire control committee, of which Kotok was chairman, then listed (1) timber, (2) site, (3) reestablishment process, and (4) future fire danger, as the four main features of damage. Forage, recreation, and game are ignored, as well as that feature which Show and Kotok were to inject later; i. e., "downstream financial interests."

It is evident that although the objectives were incompletely stated, still there was no doubt that damage was the sound basis. Every milepost in objectives from 1906 up to, but not including, 1935 will be found to be in agreement on that point.

1933. The advent of the CCC's in 1933 appears to me to have been a milepost first in finance and second in methods. Money and labor were here made available to carry out Norcross' transportation plans, Show and Kotok's standards of speed and attack, and build more airplane landing fields for Howard Flint. Cooperation between Federal, State, and private agencies also was pushed ahead in a significant surge. Coincident were funds for greatly expanded research of certain types and better facilities.

But the CCC's brought a surge in methods too, for with that volume and type of labor came both the opportunity and the absolute need of training fire-fighting crews. The man-passing-man, the sector method, the one-lick, and the 40-man shock crew methods of large fire suppression all seem to have been accelerated by the advent of the CCC's.

New ideas not only grow best and can be tested best when you have money and men, but sometimes they are then forced on you. A similar period seems highly probable after the end of the present war. If Hornby's experience is any index of what that means to fire-research men, I hope that we can have our research well under way and not be forced into the 12-hour day and the 8-day week which he worked for 3 years while pressed by availability of CCC money and men.

1934. I have been advised by some of the consultants who helped me prepare this list of mileposts, that fire danger meters should be included. Because of my personal interest in those particular devices, I am automatically disqualified from judging that point. I therefore leave them out.

1935. The so-called "Forester's policy of control by 10 a. m." undoubtedly rates either a milepost or a tombstone on our 35-year road of progress. If and when that policy becomes clearly recognized as a temporary expedient, I believe that it will rate a milepost. If, however, it has become or ever does become the death knell of all previous objectives based on damage, then it rates a tombstone executed in the blackest of black granite. It has already cost us 6 years of attention to variable damage as an objective, but it seems to have

achieved something else which may have been, at the time, worth more than the little thought which might have been given to damage.

It is futile to open a discussion of that policy here and now. It has such a direct bearing, however, on any fire-research program which we may recommend that the import of its impact deserves serious thought.

First, the 10 a. m. policy, if fully enforced, actually sweeps into the discard all previous standards and objectives of fire control. It specifies the same standard of protection for commercial timber, reproduction, forage, water control, recreation, and wildlife. It demands the same speed of control for timber and sagebrush, goat rocks, and valley bottom site I, white pine plantation and decadent hemlock or hair-on-a-dog-back lodgepole. The letter of May 25, 1935, says: "In these respects it treats all areas on an equal basis."

Second, actually the 10 a. m. policy is not fully enforced. The framers themselves never intended that it should be. It therefore says one thing but means another. It is a monumental piece (not masterpiece) of self-deception. Instead of facing facts, it confuses them. It renders systematic fire-control planning impossible because it says that IF you cannot control the fire by 10 a. m. tomorrow by use of all available resources, you can plan on control by 10 a. m. the next day. If that fails, then you may plan for 10 a. m. the third day. Et cetera, until the rain falls! Which 10 a. m. is the fire-control planner to use? The first for commercial timber and forage, the second for old burn and goat rocks, the third, fourth, or fifth for wildlife forage? Only the first, because "In these respects it treats all areas on an equal basis."

Third, to this amateur historian it appears that the 10 a. m. policy actually had the same objective as the Show and Kotok minimum damage theory of 1923; to wit: Stronger prevention and presuppression action so as to catch fires small rather than stronger suppression action aimed primarily at keeping 10,000-acre fires from becoming 20,000—or 30,000-acre burns. There is a vital and basic difference here which will come out in our discussion of the economics of fire control. But if the main idea of the 10 a. m. policy was to catch fires while small, the use of a time criterion—the 10 a. m. tomorrow—would seem to be open to further investigation. For fires can be caught small and cheaply WITHOUT controlling them by 10 a. m. tomorrow. If one function of research is to assemble and array all the significant facts, it seems more than possible that research might contribute something here.

1936. Hornby's methodical treatment of all the significant features of fire control, especially his weighting of each factor and final integration of all of them, has been approved as a milepost by all of the consultants who have aided me in selecting the events that marked progress. While not new, in that fire-control men have always planned, Hornby systematized that planning, made it so methodical, and incorporated so many new features that all future fire-control planners were greatly aided. That is a milepost of progress.

There is one feature of Hornby's work to which I should like to call your attention. I do not believe that his work has very often been viewed from this angle. When Sparhawk set out to "provide

a basis for the proper distribution of protection funds between the different units of the organization"; when he named presence or absence of the causative agencies, cover type, climate and weather, topography, and five factors of controllability as the significant items to measure and integrate, what was he doing that Hornby did not do? Nothing! They were both aiming at the same target. Actually, Sparhawk did little more than set up the target. The records he had to use were so poor that he really had no ammunition. Hornby had far better records and he shot with those as well as with the keen eye of an experienced forest administrator. But he was actually shooting at Sparhawk's target: The proper distribution of protection facilities, hence funds, between different units of the organization.

Both Sparhawk and Hornby likewise turned to the physical conditions on the ground and said to the writers of the Use Book of 1906: "These are the factors that should be considered by each supervisor and by the forester before fixing 'the number for the full summer force of each reserve' and before deciding that 'this allotment will be final.' " They both approached the problem by beginning with the physical conditions on the ground: Sparkhawk said "causative agencies," Hornby said "occurrence rate"; Sparhawk said "cover type, topography, and controllability;" Hornby said "fuel types"; Sparhawk said "climate and weather," Hornby said "measured fire danger," etc., etc. In other words, they both approached their problem from the standpoint of the physical conditions on the ground. They both had the same objective: The proper distribution of protection facilities, but no one gave either man a satisfactory definition of "proper."

The results of many a research project have been determined, and still are determined, before the detailed research begins. The all-powerful determinant is the "approach." Start the problem of distributing facilities or funds on the basis of results attained with past facilities and funds, and you will very probably end up altogether differently than if you approach the same problem from its true beginning—the physical conditions on the ground. Graves named them in 1910, DuBois repeated them in 1914, Sparhawk reasserted them in 1925, Hornby refined them in 1936. Who will be next? And when?

1938. From Hornby's milepost in 1936 to date I cannot find a single event in objectives, methods, or finance that has proved to be of national significance in fire control. I believe that there are three reasons for this. First, in any field of human endeavor, whether it be forest-fire control or the effort to produce a temperature of absolute zero, the nearer you approach your goal the harder it is to take the next step ahead. Second, progress requires men and time to work, and these require funds. Since 1936 funds for all kinds of Forest Service work have been steadily reduced. While we have had additional "relief labor," intellectual progress in objectives and methods of fire control have not been and never will be assisted by ERA and WPA labor. Third, it is difficult to judge the most recent past. Perhaps there have been some steps proposed or taken during the last 5 years which will show up later as milestones of progress.

One recent step, which I believe will be recognized later as a milepost, was taken in Region 1 in 1938 when Sutliff proposed, and Shoemaker and Kelley approved, a uniform, standard relation between current fire danger and the percentage of manpower on duty. Before that, in 1936, for example, when class 4 fire danger prevailed on the Kaniksu Forest that supervisor would have only 23 percent of his total fire force on duty, while under the same class 4 danger the Bitterroot would have 44 percent of its men in place. The spread was even greater when danger became worse and class 5 was reported. Then the Cabinet Forest would have only 41 percent of its force on duty while the Coeur d'Alene would have 81 percent. These are extreme cases. The point is that manpower had not yet been tied to measured fire danger consistently on all forests.[3]

By 1938, however, Sutliff, Crocker, and Hand had 3 or 4 years of records to scrutinize and they did that and more, too. They analyzed. They concluded that if Hornby's principles of planning had been properly applied so that the total manpower on each forest had been properly adjusted to all the significant factors—area protected, causative agencies, fuel types, detection coverage, smoke-chaser coverage, crew attack, etc.—then when class 4 danger occurred on a forest that supervisor should put on the same *percentage* of his total manpower as any other forest experiencing the same danger.

The chart called table X–1–c in the Region 1 fire plan, which has been used in this region since 1938, is the final result of this analysis. While Sutliff himself admits that efficiency can be improved by certain small changes in the shape of this curve, this standard relation for 10 forests in Region 1 has for 4 years done for current fire danger exactly what Hornby's systematic planning did for average bad danger. Hornby's method says that when the permanent factors of danger are thus and so, the following list of stations and facilities must be *available* for occupancy and use. Sutliff's table X–1–c says that when the variable factors of danger are thus and so, the following percentage of those stations will be occupied. Two, clear-cut, logical steps, both essential to adequate fire control at least possible cost.

To my knowledge this standardization of fire control practices on several national forests was first achieved by Sutliff's table X–1–c in 1938. In 1958, when all forests have planned alike, when all are provided with facilities according to uniform consideration of the same factors, and all are manned alike according to uniformly measured danger, Sutliff's method of correlating manpower and fire danger may be judged as a milepost of progress. The possibility is sufficiently great to justify the shadow or outline of this most recent milepost.

While this concludes the list of definite and datable events which I rate, now, as milestones of progress, there has been one other type of progress which must not be ignored. This type is difficult to name and impossible to date. It is illustrated by Kelley's "Fire Code" for the Eastern Forest Region issued in 1926, and by Head-

[3] The writer has subsequently been informed that H. M. Shank had established a standard relationship and was using it on Region 4 forests previous to 1938. H. T. G.

ley's "Fire Control as an Executive Problem," mimeographed in 1928. It is illustrated by the drive to "calculate the probabilities" contained in the forester's 10 a. m. policy of 1935 (which is the best part of that policy). It is the concept that fire control is a tremendously complicated job, but one which is susceptible to orderly dispatch if the man uses his head, looks at all the factors and facilities, forms correct conclusions, and then takes action. To me it seems that this particular phase of the fire problem began when the forest reserves were created in 1904, has become increasingly important since then, and will never end. Progress has been steady, but I cannot name any particular event that stands out like a national milepost.

I am purposefully not saying anything about "regulation" as a milepost in the progress of fire control, although that idea, and especially the recent action concerning it, are certain to exert a tremendous effect in the future.

Conclusion

If this summary of some of the history of fire control appears to be primarily an attempt to pass judgment on history, then I have failed in my main purpose. My real purpose was to collect, select, and relate enough of the major events of fire control during the past 35 years so that we would have a reasonably dependable background or stage for this Priest River meeting. It may be significant that 19 of the mileposts mark progress in methods, 14 are achievements in understanding our own objectives, while only 10 major steps are evident in finances. One might question whether this shows knowledge ahead of practice, or finance retarding application.

I have tried also to assemble the "framework of ideas" within which we are trying to work out our problem, to see the problem as a whole in the light of past accomplishments. My viewpoint or "position toward this field of facts," as Pitkin calls it, is naturally influenced and perhaps controlled by my own personal experiences to date. I cannot help that, but I admit that mine is not the only viewpoint. Others undoubtedly see this field of fact from a different viewpoint. I know that I would benefit by having them do for me this same job that I have tried to do for them: review the field and tell me how it looks to them. We have done altogether too little of that in the past 20 years, and our failure has consituted a serious weakness in our work. I am convinced that many of our present disagreements would disappear if we could get together and look together at the whole valley from each of the several admittedly different vista points. And I am convinced that we here at Priest River cannot expect to lay out a sound fire research program unless we keep in mind the major events which constitute the history of our particular line of work.

SCIENCE SERVICE FEATURES PREVENTION PROJECTS

In November, Science Service, the "Institution for the Popularization of Science," Washington, D. C., sent to the subscribers of its "THINGS of science" educational service all the material items incorporated in the "fag bag" and "superstition" fire prevention projects, and features these Forest Service undertakings as "the most widespread experiment in applied psychology ever conducted in the interest of all the American people."

"THINGS of science" lists among its 5,500 subscribers mainly educators, students, and laymen with a particular interest in science, and is sponsored and distributed by subscription but without profit by Science Service in much the same way as is the SCIENCE NEWS LETTER with which many readers of Fire Control Notes are familiar.

The purpose of "THINGS of service" is to teach by circularizing disassociated individuals with actual "things" having to do with various scientific subjects—things which can be felt and seen—thereby making the projects more near, real, and understandable.

Packets are made up and distributed as the projects present themselves and the materials become available—on as near a regular monthly schedule as possible. Each packet of "things" is called a "unit" and is accompanied by a popularized letter of explanation. The letter names and gives the necessary background of the particular project involved; names, describes, and explains the use of each "thing" or item included; and usually, but not always, suggests methods of teaching or experiments for testing the effectiveness of the material.

In the case of the "Fire Psychology Unit," as the November fire prevention "THINGS of science" packet was called, the letter itself, which follows, is self-explanatory.

Fire Psychology Unit

This fire psychology unit consists of one cloth bag with tag and enclosed note, a button badge, three posters, two museum-type display cards and these sheets of information.

These are the materials for the most widespread experiment in applied psychology ever conducted in the interest of all the American people.

Pin the button badge on your coat lapel and you immediately take an active part in this Nation-wide experiment designed to save the Nation from the annual tragedy of more than 50,000 man-set forest fires on protected lands which destroy acre upon acre of valuable timber and millions of living creatures.

Forest fire fighters have an old saying that you must "Fight fire with fire." They set a back-fire, using the "scorched earth" defense against the spreading invasion of this universal foe.

Psychologists are following just about the same technique when they circulate buttons with the slogan "It's BAD LUCK to start a forest fire."

For superstition, folkways, and something deep-rooted in the customs of the people that is almost akin to fire-worship are believed to have their part in causing men to burn the woods each year.

Nine out of ten of the great forest fires of the Southland, which run free over miles of woods, are set by human hands—most of them deliberately.

The people in that region will tell you that the woods are burned to kill snakes, to keep down the ticks, to destroy boll weevils. But the answer lies much deeper.

The Button

With the button which you have in this unit of THINGS, the hope is to deliberately start a superstition to fight the superstitions of fire setters.

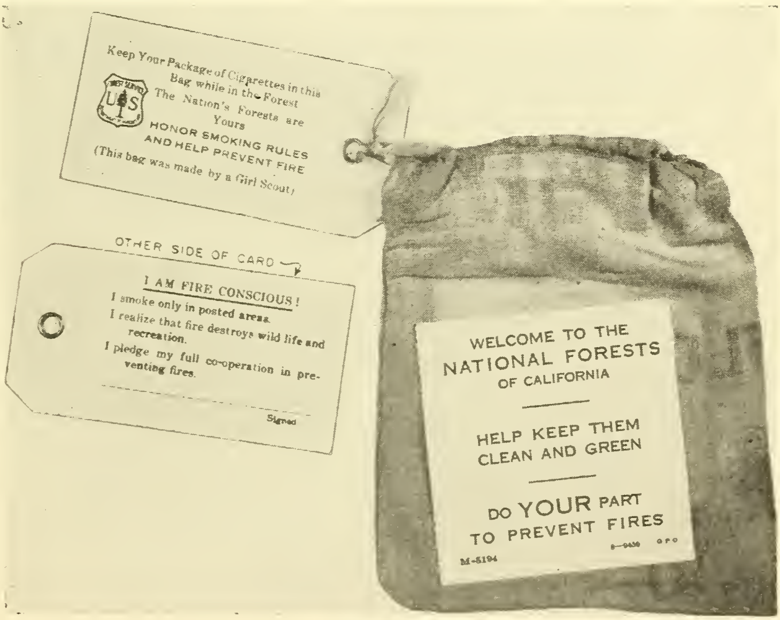
Such a plan has a precedent in the very well known three-on-a-match superstition. Many people who pass along the saying that it is "bad luck to light three cigarettes on one match" do not realize that this bit of folklore is camparatively modern. A credible story of its origin is that it dates back no further than the trench warfare of the first world war. At night up in the front lines, if you held a lighted match long enough to light three cigarettes, it was also long enough for the enemy to take his aim and fire. It was very bad luck indeed.

Whether the superstition was started deliberately for the protection of the doughboys, or whether it spread naturally, based on observation of what happened to the holder of a match kept flaming, it served effectively the same sort of purpose that Uncle Sam's forest fire-fighting forces hope to achieve in their fire-fighting psychological experiment.

Drawback to the experiment is that superstitions—whether they serve a useful purpose or not—are evil things. They can never serve as an adequate substitute for sound knowledge and enlightenment. Psychologists would be the first to assure you of that. But these men who know the workings of the human mind realize that superstitions do have an appeal that is almost universal. They are easily remembered. They work.

The Fag Bag

The cloth bag in this unit of THINGS is also being used in the great fire-fighting experiment in applied psychology. But this psychological tool is intended to make people think. Its purpose is to break up the mechanical, automatic behavior of long habit.



Fag bag

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When a smoker enters a national forest, he will receive one of the fag bags with a pledge card attached. Not only does the smoker sign the pledge to be "fire conscious," but he puts his package of cigarettes into the bag and pulls up the drawstring.

Then when he reaches for a smoke, he cannot light up thoughtlessly. The flame-red bag and its drawstring are reminders of the hazard of a careless smoke, a dropped match, a discarded glowing stub.

Psychological value of the reminder is in the timing. It comes at exactly the right moment to be most effective.

The fag bag also serves indirectly to educate the public in regard to fire dangers, through the children. The bag you have in this unit of THINGS was made by a Girl Scout. Girl Scouts made all the other fag bags used in this great fire-fighting experiment. The material for your fag bag was collected by California school children who held a "Fag Bag Day." On that day they gathered in all the sugar, salt, and flour sacks they could collect for this purpose.

You, too, can contribute by sending any such cloth sacks you may have to the nearest United States Forest Service office. It tells how on the letter to you from William V. Mendenhall, forest supervisor of the Angeles National Forest, that you will find tucked into your fag bag.

The school children who gathered the sugar sacks, the Girl Scouts who made them into fag bags, and the smokers who use them to keep cigarettes in are all made fire conscious by this experiment.

The Posters

In making use of very modern psychological devices for changing the habits of careless smokers in the forests and of men and women who have learned to follow ignorantly the generations-old tradition of burning the woods, Uncle Sam's forest fire fighters are not neglecting the older psychology of advertising.

Effective teaching through "eye appeal" is demonstrated by the posters in this unit of THINGS. Notice that each contains a dramatic painting by the well-loved illustrator, James Montgomery Flagg. Each contains a brief, compelling slogan—"Forest Defense Is National Defense," "Yours in Trust," "Your Forest—Your Fault—Your Loss." Each carries the same easily learned lesson on fire prevention in the form of nine short rules.

The Forest Service welcomes the cooperation of many organizations, companies, and agencies in their campaign of fire prevention. Psychologists know that the most effective way to learn a lesson is to take part in teaching it. One of these posters you have was carried as a full-page illustration in the American Weekly. Another poster, not in your collection, was carried in the advertising of the Texas Oil Co.

The National Fire Protection Association, various religious and fraternal organizations, the American Legion, the Boy Scouts, the Post Office Department, and the Western Union and Postal Telegraph companies are among the organizations that have joined in distributing and posting these educational posters. They are placed in post offices, schools, hotel lobbies, meeting places, and show windows.

Experiments

1. You can try this experiment on one person—perhaps yourself—but it will be more fun and more interesting scientifically if you use a group as your subjects. Have each individual follow this procedure: First, he should read the button and wear it for, say, 10 minutes. Then he should copy and sign the pledge card on the fag bag. Then he should read and study the slogan and fire-prevention rules on one of the posters. Allow about 5 minutes for this. Now take away all the materials and have him write: (1) The pledge, (2) the slogan on the button, (3) the slogan on the poster, (4) a description of the picture on the poster, and (5) as many of the fire-prevention rules on the poster as he can remember. Vary the order of the material studied and the recall for the different persons you test. This is to avoid "loading" the experiment in favor of the material studied first or last or that which it is attempted to recall first.

(Continued on page 69)

RANDOM NEWS NOTES FROM THE FOREST SERVICE RADIO LABORATORY

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The Radio Laboratory has a variety of new equipment and improvements to report which should be of interest to those associated with protection and suppression communication.

The type SX radiophone, superseding the type S, has been completed and 290 sets have been produced and are being distributed to the field. The type SX transmitter, being crystal-controlled, opens the way to improved reliability in ultra-high frequency communication networks and makes possible the successful inclusion of automatic relay equipment in such networks. The type SX can be operated on any one of three crystal-controlled frequencies merely by turning a switch on the panel of the set. The inclusion of three transmitting frequencies permits setting up one channel for local district communication, one for adjacent district or forest or regional fire communication, and one for automatic relay contact, or in any other combination desired.

An attachment, which has been designated as type SXA, provides loudspeaker stand-by service. Where it is desired to use the SX as a station or lookout-communication unit, the attachment can be plugged into the SX and a loudspeaker is then available for stand-by or for off-schedule calls.

This combination of SX and SXA provides the same service facilities as the type SV radiophone which has been discontinued. No tools are required to separate the two units and the SX can be prepared for strictly portable service in less than a half minute. In portable form the SX weighs 10 pounds.

When an SX is ordered with SXA attachment the two units are supplied in a wood kitbox. The box has storage space for heavy-duty batteries necessary for stand-by service and is equipped with heavy-duty battery cable and semipermanent type antenna.

The subject of automatic radio relaying and the purpose and possibilities of such systems was discussed under Random News Notes from the Forest Service Radio Laboratory in the October 1939 and January 1940 issues of Fire Control Notes. Two field installations were put in service in Region 5 during the past season. One relay, an A. C. operated unit, was installed on Mount Diablo, Calif., and was commissioned to provide direct communication between the fire weather office at Mills Field, San Francisco, and reporting stations on 7 different forests. The shortest path between relay and field station was approximately 75 miles and the longest about 210 miles. Aside from an hourly shifting in signal level ranging from weak to

moderately strong on the 210-mile path and on one circuit of about 165 miles the performance of this installation has been extremely gratifying.

A dry-battery operated relay installed on Grey Butte, Shasta National Forest, has further proved the possibilities of the general application of radio relaying. Tests just concluded indicate that a new circuit and system of control, devised since the Grey Butte installation, has completely eliminated the problem of normal battery voltage drop during use. It is hoped that a representative number of these relays will be put into service during 1942 to acquaint the field with the enlarged communication possibilities resulting from inclusion of this new equipment.

A new ultra-high frequency antenna for tower and other permanent antenna installations has been designed and tested. The new antenna to be known as the type PD will produce almost a 2-to-1 increase in equipment performance as compared to the type J described in the Radio Handbook. Detailed drawings of this antenna have been processed and distributed to holders of the Radio Handbook.

A development of which the laboratory group is justly proud is the new type KU–R ultra high frequency mobile radio receiver. Intensive use of 2-way ultra-high frequency communication in cars and trucks has awaited development of a receiver that would discriminate against traffic-ignition interference while providing high sensitivity for weak signals.

The much-publicized system of Frequency modulation (FM) provides this noise-free service, but there are two very important facts that rule out its application to Forest Service problems. First, the Forest Service already has approximately 2,000 ultra-high frequency radiophones, all amplitude modulated (AM) and all serving a useful purpose in communication. It would be impossible to justify a complete change-over to the new system merely to provide a more ideal mobile communication system where, incidentally, the only major improvement in service would result. Second, frequency modulation technique has not advanced sufficiently far to date to permit the production of portable units that can compete with equipment such as the SX in size, weight, and over-all low power consumption.

The new type KU–R receiver so effectively minimizes ignition interference that we can now say that reliable equipment is available for all normal forestry mobile communication problems where ultra-high frequency is desired. Provision is made in the receiver to permit tuning to any frequency in the range of 30.5 to 40 megacycles as well as for crystal-controlled spot-frequency stand-by operation. Crystal-controlled spot-frequency stand-by assures that the receiver will always be on the principal operating channel without necessity of intermittent correction of the tuning dial.

Two types of ultra-high-frequency mobile transmitters are available. One, known as the type KU–T, operates on a single frequency only and has a power output of approximately 8 watts. The other transmitter, known as the type KU–T2, is a two-frequency unit having a power output of approximately 4½ watts. Either of the two frequencies in the KU–T2 are instantly available by manipulation of a single panel control. The two-frequency unit will undoubtedly find wide application in communication systems involving automatic relays

where only frequency can be used for relaying and the other for local network operation.

Since we have mentioned two transmitters, one having a power output 1.77 times that of the other, it seems that this is an excellent opportunity to correct a general misunderstanding as to the effect of doubling the power of a transmitter. For the case at hand, if we assume that a certain arbitrary strength of signal is received at a distance of 31 miles from the 4½-watt transmitter then the 8-watt transmitter will deliver the same strength of signal at only 34 miles—not 55 miles as is often assumed on the basis of a multiplying factor of 1.77 times. This comparison assumes only that the antenna heights remain the same and that there is no radical change in topography in the two cases. The distances indicated in the example are not the maximum working range of the KZ series of transmitters, but serve merely to indicate the comparative coverage to be expected from the 4½- and 8-watt units.

SCIENCE SERVICE FEATURES PREVENTION PROJECTS

(Continued from page 66)

Notice which sort of material is remembered correctly by the greatest number. Can you tell why?

2. Invent a psychological device using the same principle as that of the fag bag to break a bad habit in your own home or community. Remember that timeliness is a key to the effectiveness of this habit-breaker. Here are some suggestions to start your thinking: Want to stop leaving lights burning when you go out of a room?—A light-weight card without sharp corners suspended in the doorway where it must bump your face as you leave the room might be effective reminder until you form the habit of reaching for the switch. Want to form the habit of studying?—Arrange the lighting in your room so that when you push your light switch only your desk and an open book on it is illuminated. (This is not recommended illumination for reading, only as a forceful reminder of your work.) Is scattering of litter on the streets a problem in your town?—Where would you place trash receptacles?—How would you mark them?—Is jay-walking a menace to traffic?—How and where would you warn pedestrians of this danger?

3. If you like a quiz, here is a question to try on your friends: Which of the following are superstitions?—(1) when you see smoke from a woods, you should make a wish, (2) you should break a burnt match twice before you throw it away, (3) a campfire should be built in a hole, (4) woods should always be burned in the autumn to clear the ground—Answer: (1) and (4). Which are useful rules?—Answer: (2) and (3).

A NEW TYPE OF FIRE EQUIPMENT IN MICHIGAN

GILBERT STEWART

Roscommon Experiment Station,
Michigan Department of Conservation

When using water in fire suppression, hand-operated pack-sack water pumps carried by individual men permit extreme mobility, quick attack, and ease of operation, but necessary refiles involve delay. Tank equipment with guaranteed delivery of larger volumes of water is less mobile and slower in attack. The author describes a new water tank-pump-trailer assembly used in Michigan which was designed to include the favorable qualities of both hand pumps and tank equipment.

For the past decade, specialized classes of mechanical equipment have been adapted to every possible phase of forest-fire suppression. In order to increase combat power of fire organizations, manual methods of attack have been supplemented by mechanical means wherever they have been applicable. There are very definite reasons for this. After fire starts, the amount of physical work which must be done, within a short time, is tremenduous. It becomes necessary to stop running fronts, and the entire fire area must be confined as quickly as possible. To do this, barriers must be constructed, immense quantities of fuel may have to be moved, and backfires may have to be set and held at correct places and at proper times. After these tasks are accomplished, there still remains the important work of mop-up and patrol.

All forest-fire agencies have to be organized and equipped to meet these hazardous conditions which constitute the extreme. Under such circumstances, the usefulness of proper machines is very great. Manpower can be conserved, organization simplified, greater flexibility in the assignment of forces realized, and the power of each individual increased, simply because much of the arduous work can be assigned to mechanical equipment.

Disastrous results may develop, however, if mechanical equipment is improperly assigned or if incorrect types are employed. It therefore becomes necessary to provide organizations with a variety of equipment. In Michigan, the assignment of mechanical equipment has become extensive, and within the past year, specialized types of tank units have been perfected for issue to the field personnel of the Department of Conservation. Up to the present time, tank equipment has not been widely used, because correct types have not been developed to meet the requirements of Michigon forest conditions.

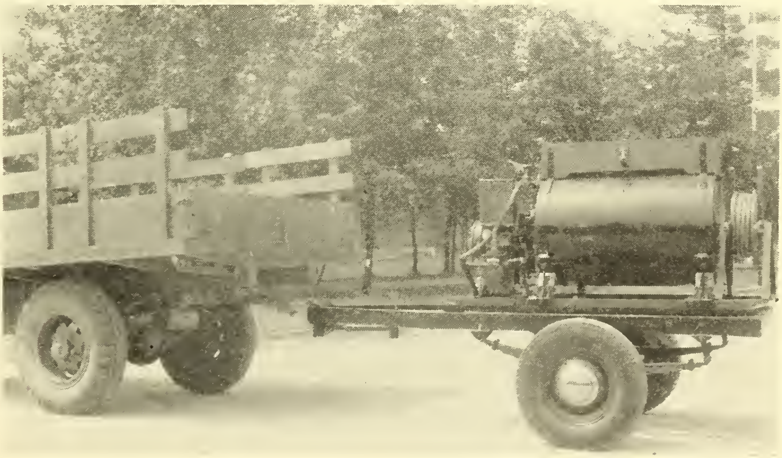
The New Equipment

The term "booster unit" has been applied to tank equipment for a long time. Such machines have been used in forest regions for a number of years, especially in certain portions of the West where no

other type of power equipment found ready acceptance. In most cases, these have been special tank units transported by trucks completely equipped for that particular purpose. Sole dependence could not be placed on machines of this kind for average duty in Michigan because great areas of hazardous character cannot be reached by truck. Additional means of transportation must be provided, which implies trailer mounting suitable for attachment to any truck, pick-up truck, car, or tractor.

A type of tank equipment has been developed at the Michigan Forest Fire Experiment Station which fulfills the requirements of field assignment in this region. Experience had proved that water-pumping equipment could be used with great success in Michigan, where water normally is readily accessible. However, pumping units were restricted to hand-operated pack-sack pumps to do heavy-duty stationary machines. The pack-sack pumps, carried readily by one man, permitted extreme mobility, rapidity of attack, and ease of operation. The working time is relatively short, however, and frequent refills are absolutely necessary to maintain high efficiency on running fire. Power-pumping equipment guarantees the delivery of large volumes of water at any desired point; but fast attack is not usually possible, and there is absolutely no mobility while in use, except as hose line can be shifted.

Analysis of field requirements indicated that a third class of machine was greatly needed. The chief requirements were extreme mobility, long working time, moderate capacity, and the reliability of power delivery of water under high pressure. A unit of this kind would incorporate all the advantages of back pumps in terms of mobility and greatly increase the quantity of water carried in one mobile outfit. The weight and bulk involved, however, would take the machine completely out of the class of manually operated equipments consist of a tank assembly, complete with self-contained power pump would guarantee all the advantages of mechanical pumping without robbing the unit of mobility or restricting it to stationary duty.



MICHIGAN DEPARTMENT OF CONSERVATION

Water tank and pump assembly mounting on special trailer pulled by truck.

The machine which has been built in accordance with the requirements consist of a tank assembly, complete with self-contained power pump, tool box, and hose reel. The entire outfit is attached to a sled-like base, and the assembly is one complete unit; all pipe lines and hose lines are permanent and ready for instant use. Inasmuch as the unit is completely self-contained, it may be transported by any truck, pick-up truck, or trailer, which eliminates the necessity for a special truck.

MICHIGAN DEPARTMENT OF CONSERVATION

Water-tank machine, pulled by tractor, in operation on fire line.

A special trailer is a standard part of the outfit, but its use is optional. Trailer transportation, however, permits extreme flexibility in field assignment, and tractors may transport the outfit over rugged terrain and into isolated places where truck transportation would be impossible. Practically all portions of fire fronts may be reached with tractor-trailer transportation.

Actually, the assembly of self-contained tank units is not particularly new. The specialized design and the features which have been incorporated in the new equipment, however, make it particularly adaptable for woods work. The entire unit is 6½ feet long, 30 inches wide, and 40 inches high. The tank capacity is 110 gallons. The complete pumping unit is manufactured by the Novo Engine Co., and its capacity is 5 gallons per minute with a pressure range up to 300 pounds. Power is provided by a 2-horsepower motor, and 2 pumps are driven by it. In addition to the reciprocating pressure pump, an auxiliary centrifugal pump is used for purposes of filling the tank only. These 2 pumps are used at different times: the pressure pump is employed for fire fighting only, and the centrifugal pump for refilling the tank. A selective clutch permits disengagement of the aux-

iliary pump—but the latter is primed by the pressure pump by a special arrangement of hose lines and valves connecting them.

Starting with a full tank, the average working time is about 1 hour 20 minutes. In actual service, water is seldom discharged continuously. This necessitates the installation of a bypass on the pressure pump, which permits water to pass from the pump back into the tank or intake line when the nozzle is closed and eliminates the necessity of stopping both pump and motor when water is not to be discharged.

Ordinary high-pressure hose may be used, size ½ inch and 75 feet long. A special nozzle gun completes the hose assembly. This is a spray gun with a shut-off valve in the handle, by means of which the discharge or stoppage of water is under the immediate control of the operator. The bypass and nozzle gun are features which greatly increase the convenience, usefulness, and efficiency of the entire outfit. Without them, water would be continuously discharged with great waste, unless the pumping unit were stopped very frequently. As it is, the unit can be transported along a fire front with the motor and pump in operation and water discharged only when necessary.

Convenience in operation is provided by a fully equipped tool and accessory box mounted permanently over the tank, so arranged that every spare part and tool has one particular space. A full kit of necessary tools is included, together with a variety of spare nozzles, spray head with a selection of disks, gaskets, foot valve, spare fuel, and oil. Full instructions for operation and care are framed in the lid.

All tractors, trucks, and cars used by the department are equipped with standard interchangeable trailer hitches so that transportation is guaranteed by all of these classes of equipment.

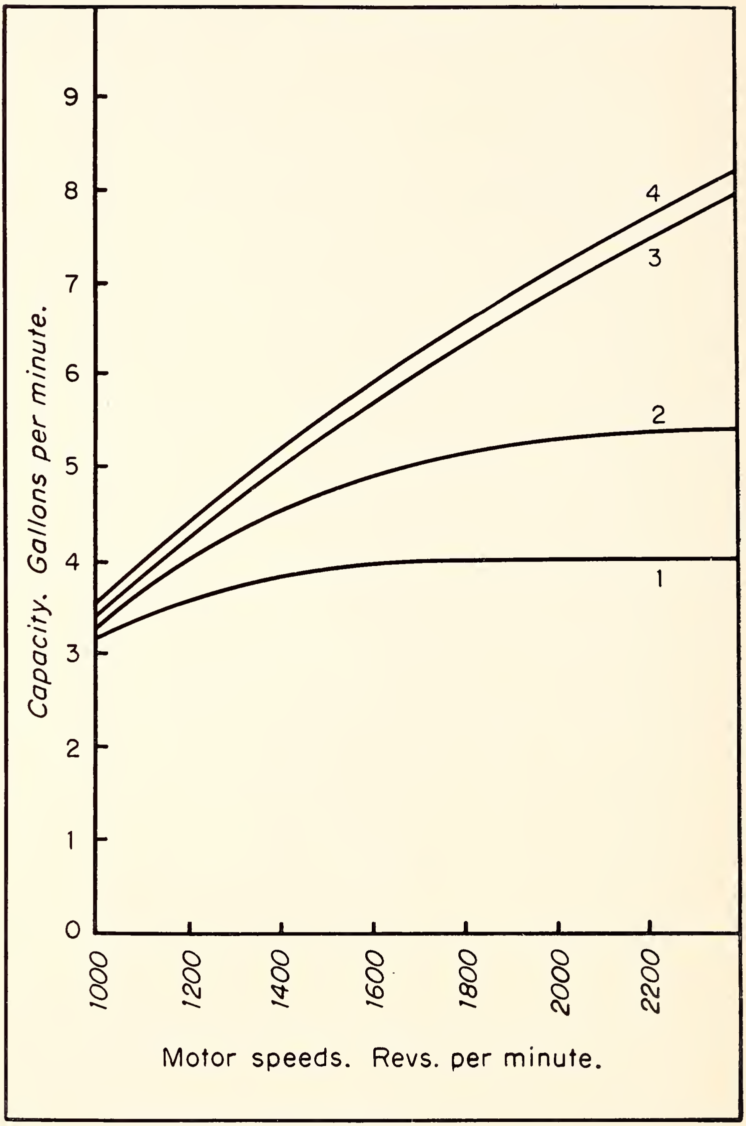
Performance Ratings

Carefully controlled tests conducted at the Experiment Station have determined the capabilities of the pumping unit with which these machines are outfitted. Tables 1 to 4 contain the data assembled from these rating tests.

TABLE 1.—*Performance rating of the Novo pressure pump, Model AU—Capacities developed when operated over a full range of speeds, and when using different sizes of nozzle equipment*

Motor speed (revolutions per minute)	Size of nozzles				Motor speed (revolutions per minute)	Size of nozzles			
	3/32 inch	1/8 inch	3/16 inch	1/4 inch		3/32 inch	1/8 inch	3/16 inch	1/4 inch
	Gallons per minute	*Gallons per minute*	*Gallons per minute*	*Gallons per minute*		*Gallons per minute*	*Gallons per minute*	*Gallons per minute*	*Gallons per minute*
1,000	3.2	3.3	3.43	3.5	1,800	4.0	5.2	6.4	6.58
1,100	3.4	3.75	3.86	3.95	1,900	4.0	5.25	6.7	6.88
1,200	3.6	4.1	4.3	4.38	2,000	4.0	5.3	6.95	7.15
1,300	3.75	4.4	4.7	4.8	2,100	4.0	5.33	7.25	7.42
1,400	3.85	4.65	5.05	5.18	2,200	4.0	5.35	7.5	7.68
1,500	3.9	4.83	5.42	5.58	2,300	4.0	5.38	7.75	7.9
1,600	3.96	5.0	5.75	5.92	2,400	4.0	5.4	7.95	8.1
1,700	4.0	5.1	6.1	6.28					

Governed motor speed is 1,200 revolutions per minute. The pump operates at one-tenth of the speed of the motor.



Capacities obtainable with the Novo pressure pump, Model AU, when equipped for booster duty. Curve 1, 3/32-inch nozzle; curve 2, 1/8-inch nozzle; curve 3, 3/16-inch nozzle; curve 4, 1/4-inch nozzle.

TABLE 2.—*Performance rating of the Novo pressure pump, Model AU—Pump pressures developed when the unit is operated over a full range of speeds, and when using different sizes of nozzle equipment*

Motor speeds (revolutions per minute)	Sizes of nozzles				Motor speeds (revolutions per minute)	Sizes of nozzles			
	3/32 inch	1/8 inch	3/16 inch	1/4 inch		3/32 inch	1/8 inch	3/16 inch	1/4 inch
	Pump pressure—Pounds per square inch					Pump pressure—Pounds per square inch			
1,000	250	175	60	50	1,800	300	300	195	150
1,100	275	217	78	62	1,900	300	399	211	163
1,200	300	246	96	75	2,000	300	300	226	175
1,300	300	275	113	87	2,100	300	300	241	187
1,400	300	300	131	100	2,200	300	300	256	200
1,500	300	300	147	112	2,300	300	300	271	212
1,600	300	300	163	125	2,400	300	300	285	224
1,700	300	300	180	138					

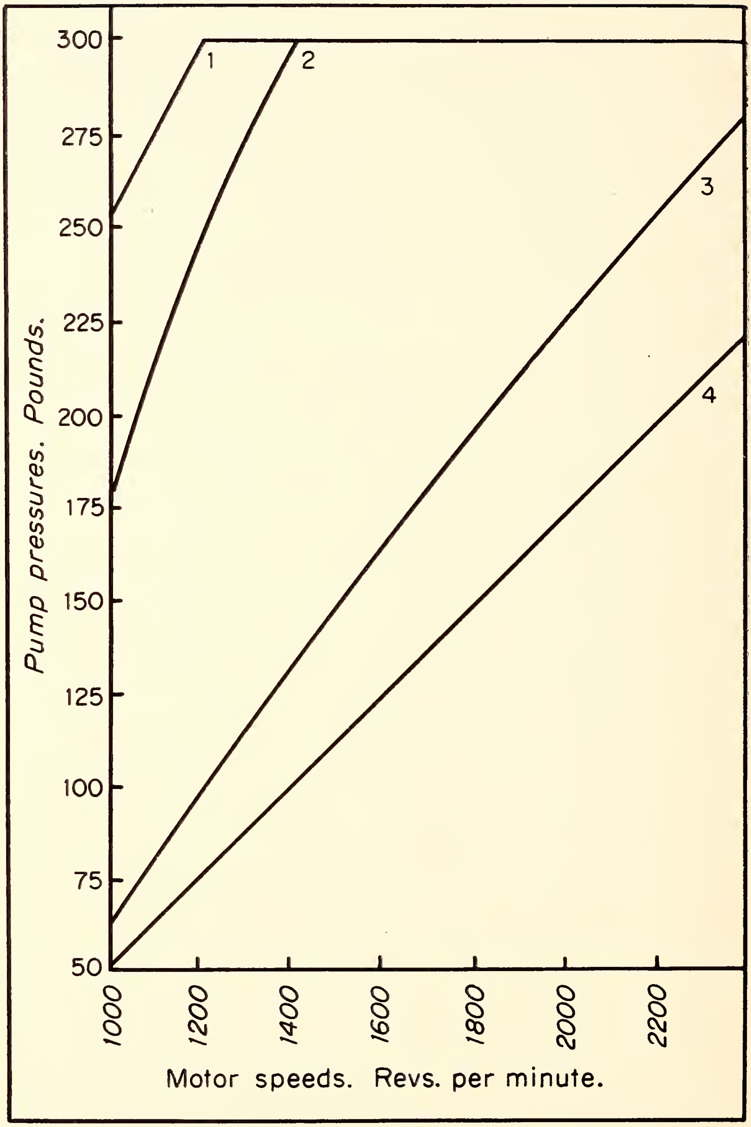
The bypass valve on this particular unit was set at 300 pounds. Normal setting is 275 pounds. Pressures higher than the valve setting are impossible to develop. Water passing through the bypass valve returns to the intake line. Governed motor speed is 1,200 revolutions per minute.

TABLE 3.—*Performance rating of the Novo pressure pump, Model AU—Remaining nozzle pressure available for fire suppression, when the pump is operated over a full range of speeds, and when using different sizes of nozzle equipment*

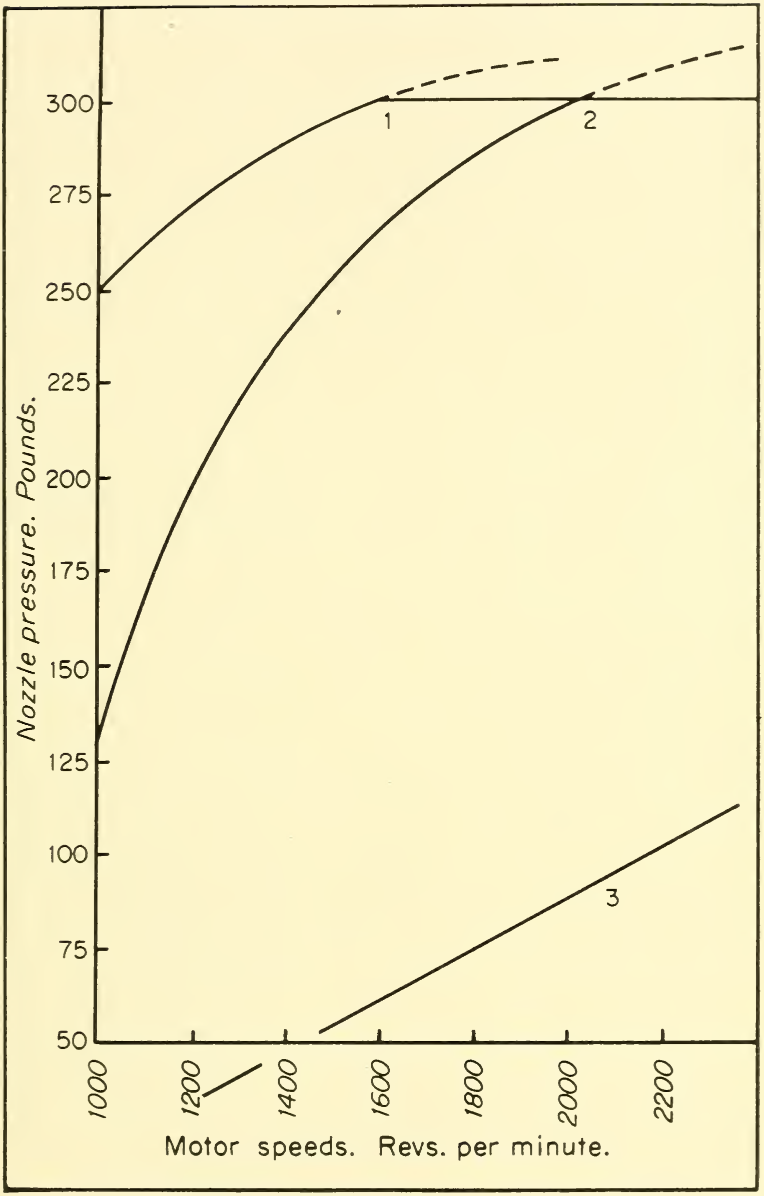
Motor speeds (revolutions per minute)	Size of nozzles				Motor speeds (revolutions per minute)	Sizes of nozzles			
	3/32 inch	1/8 inch	3/16 inch	1/4 inch		3/32 inch	1/8 inch	3/16 inch	1/4 inch
	Nozzle pressure—Pounds per square inch					Nozzle pressure—Pounds per square inch			
1,000	250	130	21	1	1,800	300	287	75	7
1,100	265	165	28	1	1,900	300	294	83	8
1,200	274	195	35	2	2,000	300	300	90	9
1,300	283	217	41	3	2,100	300	300	96	10
1,400	290	237	48	4	2,200	300	300	103	11
1,500	295	255	55	4	2,300	300	300	110	12
1,600	300	268	63	5	2,400	300	300	116	13
1,700	300	280	69	6					

TABLE 4.—*Road test under actual field conditions, showing the performance of the machine in terms of road mileage with constant water delivery; working time; capacities and pressures developed with standard types of hose equipment and when the motor is operated at the proper governed speed of 1,200 revolutions per minute*

Nozzle type	Size of orifice	Capacity	Pump pressure	Road mileage	Working time	Car speed	Remarks
	Inch	*Gallons per minute*	*Pounds*	*Miles*	*Minutes*	*Miles per hour*	
Spray disk	3 1/32	1.42	300	4.6	69½	3–4	3-way spray head.
Do	7/64	3.75	300	1.8	27½	3–4	Single spray disk.
Straight	7/64	4.25	275	1.8	26¼	3–4	Good stream; grass, brush.
Do	3/32	3.6	300	1.9	32⅔	3–4	Do.
Do	1/8	4.1	246	1.45	27½	3–4	Fair stream; grass, brush.
Do	5/32	4.3	150	1.8	24½	4–5	Too little pressure.
Do	3/16	4.7	100	1.6	23⅗	3–4	Do.



Pump pressures obtainable with the Novo pressure pump, Model AU, when equipped for booster duty—Curve 1, 3/32-inch nozzle; curve 2, 1/8-inch nozzle; curve 3, 3/16-inch nozzle; curve 4, 1/4-inch nozzle.



Remaining nozzle pressures available for fire suppression with the Novo pressure pump, Model AU—Curve 1, 3/32-inch nozzle; curve 2, 1/8-inch nozzle; curve 3, 3/16-inch nozzle.

It is obvious that a selection of nozzle equipment is available, and a choice can be made depending on the requirements of the work to be done. Those requirements cannot be established by rule; efficient use of the outfit depends largely upon the experience and training of the fire officers using it. However, some generalization is permissible. Spray nozzles can be used very successfully with high pressures; they are effective on grass fires and other light types of fuel where close approach is permissible. Dense, foglike jets are produced, especially by the multiple-head nozzles, which appear to have a deadening effect far out of proportion to the quantity of water discharged. In all probability a smothering effect is produced, in addition to the drowning action of the water itself.

Sharp, cutting streams are produced by the standard straight nozzles. They are effective at distances up to 30 feet and are used with good results on hot types of fuel which do not permit close approach. Because of the high pressures developed, they derive much of their effectiveness from striking force, in addition to the wetting and cooling action of the water itself. In suppressing fire, given quantities of water are always more efficient when delivered at high pressure, which is especially desirable in small-capacity power pumps. Pressures of less than 150 pounds should not be used for booster duty; pressures of 200 to 250 pounds produce really effective results, and nozzle equipment must be selected accordingly.

Organization and Field Assignment

The real value of new developments in mechanical equipment is never measured solely by laboratory rating tests. Success or failure is determined by actual use in fire suppression. Many different classes of machines have proved successful simply because they have eliminated tremendous amounts of physical labor. Devices which simplify and make organization flexible are extremely useful, particularly when manpower is scarce. Small booster units because of their performance, promise to be especially successful in Michigan. Considering the fact that each unit has a tank capacity of 110 gallons, they are equal to 22 men equipped with pack-sack pumps as far as actual quantity of water is concerned. When transported by truck or trailer, they are exceedingly mobile, and guarantee fast attack and considerable combat power while fires are small. Even on large fires which grow beyond their capacity, these small outfits fill important places in the organization. Under present-day conditions, many fires occur by roadsides or are stopped at roadsides, and one booster unit can undertake the fast patrol of miles of such fire front, thereby freeing many men for assignment along other portions where automotive travel is difficult or impossible. Backfires, or burning-out fires, are usually set at some barrier such as roadside or firebreak, and this work proceeds with great rapidity with the aid of booster equipment.

Irrespective of roads, few places are too isolated to be reached by booster equipment hauled on trailers behind tractors. In fact, this type of assignment promises to increase the usefulness of tractors on fire location.

MICHIGAN DEPARTMENT OF CONSERVATION

Water-tank machine pulled by tractor cross-country through forest en route to fire.

It frequently happens that tractors are removed from duty after adequate fire lines have been constructed, because they are one-purpose machines and no additional work can be done with them. If booster equipment is available, however, tractors can be assigned to patrol duty along all fronts, and the tank unit can be trailed to any desired location for holding backfires and mopping-up portions of fire line that have been successfully held. In this particular phase of work, tank units will probably never completely replace well organized foot crews, but their value can hardly be overestimated in increased combat strength and flexibility of organization that may be gained through their use. Their aid in mop-up and patrol is effective on any fire, especially when crews are exhausted from previous work. Present-day assignment of tractor equipment is for the single purpose of fire line construction. As sufficient tank equipment becomes available, its use will be extended; transportation of booster equipment on trailers by tractors will be considered a function of these machines, equally as important as the drawing of plows.

Disadvantages of Tank Equipment

Certain field conditions tend to reduce greatly the usefulness of booster machines. Of necessity, they must possess considerable bulk and weight. Absence of passable roads, thick cover, rough terrain, and scarcity of surface water for refills are factors which place booster machines at a disadvantage. Like all power equipment, they are not adaptable everywhere, and in localities where adverse con-

ditions exist, considerable care must be exercised in their assignment. Fire organizations, therefore, must be familiar with the situation throughout each district and govern the assignment of tank equipment accordingly. This must be done with all other classes of power equipment, however, and entails no redrafting of fire plans.

Probable Use of Tank Equipment

Throughout most of the forested areas of Michigan, many miles of roads and firebreaks have been constructed during the past 5 years. Moreover hundreds of miles of sand trails have been used for years by fire organizations. These conditions favor the extensive use of tank units because large areas of wild land can be reached by them. They may be dispatched speedily with a crew of 2 men in charge, and permit fast attack on roadside fires with the water carrying capacity equivalent to that of 22 men. In view of the progress being made in the use of cheap chemicals, it is probable that booster units will be the means of handling them on fire location. Whether or not full dependence will be placed on small units of 110 to 150 gallons capacity cannot be predicted. Water is so useful on fire location that larger units are almost sure to be employed, in which case tank capacities will range up to 500 gallons, with pump capacities of 10 gallons per minute.

Conclusions

Based on experience with booster units dating from 1932, certain conclusions are permissible.

1. Forest conditions throughout Michigan favor the use of tank units. Many areas, such as the surface rock localties around Alpena, will not permit the use of any other kind of power equipment.
2. Extreme mobility is of great importance; outfits of 110-gallon capacity permit transportation by light truck or trailer, or behind any car or tractor.
3. Trailer mounting is essential; it avoids tying up special truck equipment solely as tank trucks; hence a large number of cars or tractors may provide transportation when equipped with interchangeable trailer couplers.
4. Flexibility of organization is guaranteed through the use of booster units because duties such as patrol and mop-up can be alloted to them, thereby freeing men for assignment at other places.
5. Power of attack is increased. The tank capacity of 110-gallon units equals the quantity of water carried by 22 men with back pumps.
6. Use of booster units increases the usefulness of tractor equipment. After fire lines are constructed, trailer-mounted tank units may be hauled by tractors along all portions of a fire front.
7. Booster units offer the best chance for extensive use of chemicals in the future. Use of chemicals is not yet justified, but if they are ever employed, liquid chemicals will require self-contained tank units to handle them.

REDUCING FIRE SUPPRESSION COSTS WITH RADIO COMMUNICATION

WALDO M. SANDS

Project Superintendent CCC Camp Wellston, F–68, Michigan

Reduction of fire suppression costs has been the goal for many years of all personnel connected with fire-fighting organizations. Increased fire costs generally result from:

1. Poor organization.
2. Lack of proper communication, resulting in:
    - (*a*) Inability of initial attack crew to get into immediate contact with the towerman or dispatcher.
    - (*b*) Overmanning of fires through sending relief crews by dispatcher or towerman, because of lack of immediate contact with first crew on fire.
    - (*c*) Sending crews from camp or other main stations, thus adding to transportation costs and risking increased burned area through loss of time in travel, when crews in immediate vicinity, if they had been equipped with mobile stand-by communication, such as a portable radio set, could have been sent while fire was small.

The use of radio both in fire detection and suppression during the summer of 1941 by Camp Wellston fire crews proved it to be the most efficient and economical means of communication used to date for fire suppression. This was demonstrated on two fires, on which the burned area and costs could have reached major proportions had dependence been placed on telephone lines for communication.

Pickerel Lake Fire

The Pickerel Lake Fire in sec. 8, T. 20 N., R. 15 W., on July 29, was one of the fires on which the effectiveness and economy of radio were demonstrated. The fire occurred on a low hazard (2) day when the dispatcher and towerman were not on duty. Starting sometime in the morning, the fire burned slowly until shortly after noon, when, whipped up by a sudden high wind, it was discovered by a local man, who reported it to Camp Wellston at 3:11 p. m. The superintendent immediately sent a small crew to the fire with a competent foreman and instructed the switchboard operator at the Wellston Guard Station to stand-by the radio there, and to mount the Udell Lookout towerman and have him stand-by his radio.

Upon arrival at the fire with a few additional men, the superintendent made a rapid survey of the fire, which had started along an east and west road in an old field furrowed and planted to jack pine in 1939. The area at the point of origin of the fire was covered by a rank growth of sedge and junegrasses. The fire, although checked by the furrows, spread rapidly into a heavy overstory of natural jack pine and oak, saplings and poles. The wind was in the southwest and blowing at the rate of 9 miles per hour. Bordering the burn to the north

was an area of slash from the previous winter's TSI operations, toward which the fire was spreading and which it reached before it was controlled.

It was decided that the crew on the fire could control it, and communication was established immediately with the Udell Lookout towerman, using the radio set mounted on the stand-by fire truck. This radio set, incidentally, is part of the fire equipment of Camp Wellston's stand-by unit during the fire season. Needed crew reinforcements for relief and mop-up work were called out, food and water ordered for the fire fighters, and directions given as to the fastest and shortest route to the fire.

The radios on the truck and in the tower were type T radiophone transmitter-receiver, ultra-high frequency sets, operating in a range of 30,000 to 40,000 kilocycles. Messages were relayed by the towerman to the Wellston dispatcher's radio, which is a type U, ultra-high frequency, transmitter-receiver radiophone. Relaying was necessary because of the range of hills between fire location and dispatcher, which made direct communication difficult.

Lack of the radio would have required traveling 10 miles to a telephone line to establish communication with the tower and camp, using additional truck mileage, and losing valuable time when minutes could have meant the loss of a planted area of 210 acres and other timber. Immediate contact with the towerman also made it unnecessary to dispatch additional reinforcements as is customary when communication is delayed and the volume of smoke indicates the fire is not suppressed, which would have caused a large and unnecessary man-day cost. Direct communication with the towerman forestalled an error in judgment in deciding what was the smallest crew possible for control of the fire, as reinforcements could be called out quickly if an emergency arose.

Because of the direction of the wind, the fire burned itself out partially against a fire lane on the east side of the burned area, but had the wind blown from a southeasterly direction, the fire could not have been controlled with the first crew on the scene of action. Any delay which would have prevented establishing prompt communication with the towerman and camp would have meant disaster and the probable loss of several hundred acres of planted and natural-growth area. The saving effected on this fire, shown below, is representative of the many fires on which radio communication has been used successfully.

Increased costs for this fire, had telephone communication been used, were estimated as follows:

Distance to and from telephone line—24 miles with pick-up, at $0.045 per mile	$1.08
Enrollee and superintendent's time lost (1 hour)	1.30
Crew man-days saved on reinforcements—15, at $1.50	22.50
Two trucks at 35 miles each—70 miles, at $0.065 per mile	4.55
Two foremen (time lost—3 hours)—6 hours, at $0.62 per hour	3.72
Total	33.15
Potential damage, assuming fire had not been controlled by first crew and a ½ hour delay had occurred before communication could be established, would have been 210 acres of planted area and 350 acres of oak and jack pine natural reproduction burned, at an estimated value of	3,270.00
Total damage sustained through fire (actual)	291.00
Difference between actual and potential damage	2,979.00

Maple Street Fire

The Maple Street Fire, sec. 14, T. 20 N., R. 17 W., in the Grant Extension, was another example on which radio communication was an indispensable and cost-reducing factor. This fire was reported at 1:53 p. m., August 5, 1941, to the district ranger at Manistee, who left with 5 men to locate it. On arrival at the reported location, no fire or smoke were visible. Because of the flat terrain and heavy growth of timber on all sides, locating the fire by search would have been extremely difficult. The ranger immediately contacted the towerman at Grant tower with a type A set mounted in the dashboard of the ¾ ton International, pump-type pick-up. By establishing his location with the towerman through description of the ground and landmarks, he determined the cross-shot was in error, and was able to correct himself as to the true direction of the fire and eventually reached the burning area at 2:30 p. m. The fire, ¾ of a mile off the main road and almost in the center of a section, was difficult to find. It had started at the edge of an alder and marsh-grass swamp and was burning its way deeper into the swamp. Wind velocity was 15 miles per hour, danger class 5. Rate of spread was 3 feet per minute, but gaining rapidly, because of wind velocity and additional heat from increasing spread of burned area. Area increased 7 acres from time of attack until controlled.

There was no telephone line closer from Manistee, 9 miles away. The delay caused by returning to Manistee or to the tower to try to relocate the fire, based on fire conditions, fuel, type of fire and rate of speed, would have allowed the fire to triple in area, and a larger number of man-days and more supervision would have been required to control it. In addition, the time lost looking for the smoke would have further increased the number of man-days and tended to give the fire time to burn and perhaps reach major proportions.

Analysis of the probable increased costs of this fire, if radio communication had not been available follows:

Probable time lost in looking for fire and establishing telephone communication—5 men and ranger—2 hours	$3.70
Increased area over total burned, because of time between discovery and attack—27 acres—increase in damage	21.60
Probable increase in reinforcements in excess of needs because of failure to locate fire—25 men and foreman	7.24
Truck mileage in excess of needs—60 miles at $0.065 per mile	3.90
Total increased costs	36.44

It is admitted that in both fires we have set up hypothetical cases based on the burning conditions and fire behavior, but it is believed these figures bring out the fact that regardless of the problematical side of the picture, certain definite costs were reduced because of the quick contact established with the towers. Cost reductions were caused by:

1. Less transportation.
2. Use of minimum number of effective man-days for fire suppression.
3. Less time lost in locating fire.

4. Fewer crew reinforcements.
5. Smaller burned area loss.
6. Added protection in case of emergency (intangible cost); i. e., such as sudden shift in wind direction.

THE PRIEST RIVER MEETING

(Continued from page 46)

and influence the right people. Recent advances in applied psychology and in methods of sampling and studying mass opinion seem to offer effective tools that research could investigate and develop to aid administration in increasing the effectiveness of fire-prevention work.

Emphasis in the fields of effects and behavior was toward getting a more complete basic knowledge. Significant was the recommendation of the committee accepted at the meeting that "* * * fire-danger-rating research be temporarily suspended as soon as current work reaches a reasonable stopping point. It is recognized that existing fire-danger-rating systems only partially satisfy the needs of fire control, but pending the more precise definition of the elements of fire behavior, it is believed that more rapid progress in this field will be made by the study of these elements than by further direct study of danger at this time."

The fire-control organization and management committee was handed a very broad assignment and responded in kind. Their job was to examine research needs in problems of detection planning, communications, transportation, fire-suppression organization, and tactics, all having a direct tie-in with control by the administrative organizations. It is here that the big money is spent and even a relatively small percentage increase in efficiency means a sizeable gain. The committee recognized a definite need for objective study in the general field of fire-control management and outlined a comprehensive program of needed work divided between the research and administrative organizations.

A strong point of the meeting was the closeness with which research and administrative men work together. In all discussions full consideration was given research needs for the protection of State and private forest areas as well as those on the national forests. The fine facilities at the Priest River Experimental Forest and the smooth handling of arrangements by the Northern Rocky Mountain Station contributed much to the success of the meeting. As a wind-up, the Southerners were treated to a good Western snowstorm.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Legends for illustrations should be typed on a strip of paper attached to illustrations with rubber cement. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing illustrations, place between cardboards held together with rubber bands. Paper clips should never be used.

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustration. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired. Do not submit copyrighted pictures, or photographs from commercial photographers on which a credit line is required.

India ink line drawings will reproduce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.

The approximate position that illustrations bear to the printed text should be indicated in the manuscript. This position is usually following the first reference to the illustration.

VOL. 6 JULY 1942 NO. 3

FIRE CONTROL NOTES

A PERIODICAL DEVOTED
TO THE TECHNIQUE OF
FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and technique may flow to and from every worker in the field of forest fire control.

Volume 6 Number 3

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FIRE CONTROL

*

FIRE CONTROL NOTES is issued quarterly by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., 15 cents a copy, or by subscription at the rate of 50 cents per year. Postage stamps will not be accepted in payment.

The value of this publication will be determined by what Federal, State, and other public Agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

Address DIVISION OF FIRE CONTROL
Forest Service, Washington, D. C.

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CONTENTS

Much as we regret it, this will be the last issue of Fire Control Notes during the war. However, if you have any suggestions that might be helpful to others engaged in fire control activities, and will send them to the Forest Service, Washington, D. C., such data as seem to warrant it will be passed along to those most likely to be interested by including in administrative memoranda or by other means.

Erratum.—In the article by H. T. Gisborne, "Review of Problems and Accomplishments in Fire Control and Fire Research," Fire Control Notes for April, 1942, line 31, page 55 should read—"economic theory, but merely as a moderator of evener. This is * * *"

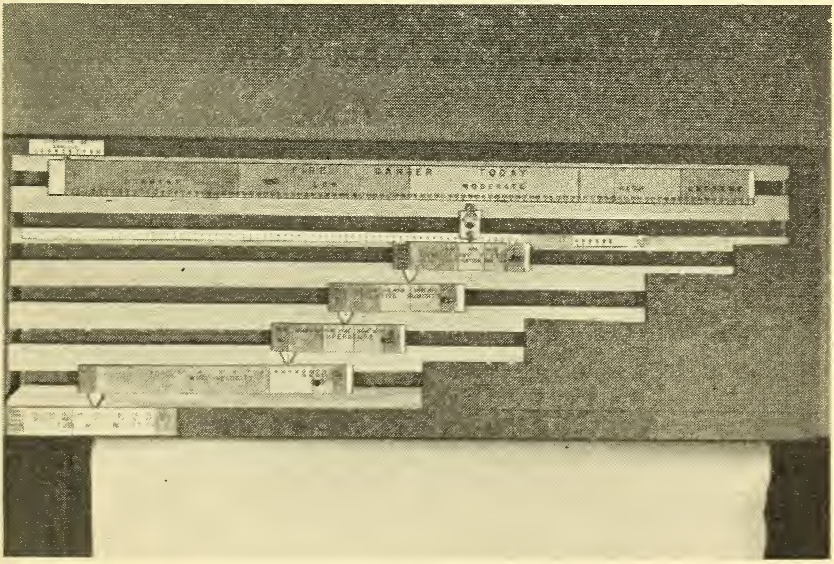
STREAMLINING THE R-2 FIRE-DANGER METER

Paul P. McCord

Assistant Supervisor, Pike National Forest, Region 2, U. S. Forest Service

"I wish we had our fire-danger meter so arranged that when all the component factor scales have been set the fire danger would be automatically shown." Thus spoke Mr. A. A. Brown of the Regional Office at the time of an inspection trip on the Pike last fall. Following some humor about connecting the scales to rheostats and other electrical gadgets, Messrs. Brown, Dakan (Project Superintendent, F–60 CCC camp), and I did some serious thinking about the matter without serving at any definite conclusion as to how it could be done. For a couple of months I amused myself at odd moments thinking through the possibilities of solving the problem by designing a meter that would be simple and cheap to construct, stand up well under use, have a certain amount of eye appeal and eliminate necessity for off side calculations either mental or scribbled.

Finally these ideas crystallized and the preliminary model shown in the accompanying photograph was constructed. As can be seen, the FIRE DANGER TODAY is indicated by the upper scale which contains 100 points. Below this, in turn, are scales for CUMULATIVE EFFECTS, RELATIVE HUMIDITY, TEMPERATURE, WIND VELOCITY, and FUEL MOISTURE STICK.



R–2 fire-danger meter.

(Continued on page 91)

FIRES IN ALASKA

J. N. Hessel

Information and Education, U. S. Forest Service, Washington, D. C.

When the heat's on in the timber and above the jangling of the telephone or the cracking of the flames you hear in strident, stentorian tones something like this: "I'm gonna quit this business and find me a place somewhere in the middle of a swamp"—you can figure you're in the presence of an experienced fire fighter and that everything is being well taken care of. The more stentorian and profane this proclamation, the more experienced the fire fighter is likely to be.

Top-notch forest-fire fighters go around making this fervent announcement all summer and brood about it all winter. None, or at least very few of them, ever actually do any thing about it. This also is typical.

And another item these heroes of the hot spots hold largely in common in this connection has to do with Alaska. In their most morose moments, Alaska is the land generally regarded as the utopian escape from all fire-control worries and troubles—a land where the need for fire control and the problems thereof drop to an irreducible minimum—a land where the forester can proceed with his anointed silvicultural endeavors unmolested and forget about forest fires once and forever.

Granted the opportunity of an extensive Alaskan junket with Dr. Dow V. Barter of the University of Michigan, and his student assistant Fred Walker, last summer, I set this matter down as one for special investigation.

Via the Alaska Steamship Line's S. S. *Alaska*, after stops at Metlakatla, Ketchikan, Juneau, Cordova, Valdez, and half a dozen isolated salmon canneries, we eventually arrived in Resurrection Bay and disembarked at Seward.

Anyone can see that the relationship between fish and fire, except for the alliteration of the two words, is almost purely antithetical. And after 8 days on the S. S. *Alaska*, during which I had talked fish, smelled fish, seen fish, eaten fish, and otherwise become so full of fish as to believe nothing else in Alaska commanded any attention, it was natural that on arrival in Seward the business of fire was farthermost from my investigative apparatus. The only connection was a nausea for fish the same as I had felt for fire in other times and climes.

On turning up at the Forest Service headquarters of the Kenai Division of the Chugach National Forest in the Federal Building in Seward, searching for one Emil "Whitey" Norgorden in charge, I was therefore due for a shock.

Ranger Norgorden, I was informed by office manager Joe Werner, was at Kenai Lake where he had been and where he would remain for the duration of the *fire season.* It was then late July, and as nearly as I could gather this meant from early June to early September, depending on the time of spring break-up and fall rains, just as in the Northern Rockies and Pacific Northwest.

Although an occasional fire is started by brush-burning homesteaders, by prospectors, or by sportsmen who travel far to enjoy the famed hunting and fishing of the Kenai country, the chief hazard—believe it or not—is a railroad. Also, believe it or not, it's a Government-owned railroad.

This railroad extends from Seward to Fairbanks, and the trains which run at odd, infrequent, and indeterminate intervals have at one time or another started whopping big fires practically from one end of the route to the other. One of the features of the line is the famous screw trestle which gets the road out of the valley and over the mountain in a hurry. This is a renowned scenic thriller for the sightseer, but to the Kenai ranger it's a pain in the neck.

The matter of screens on the locomotive smokestacks has never been satisfactorily settled. During the burning season a speeder patrol

F—94157

Forest fire along Iditarod River, Alaska.

after every train making the haul over the mountain is considered essential.

We traveled over the Alaska Railroad to Anchorage. In an office in the Anchorage Federal Building I found W. N. "Bill" McDonald and Roger R. Robinson representing the Department of Interior's Alaska Fire Control Commission. Bill, an old-time Alaskan, put in many years as a member of the Region 10 Forest Service organization, previous to taking over in Anchorage. Robinson, a graduate forester from New York State College, also previously served with the Forest Service in West Virginia, Colorado, and Alaska.

"Folks in the States have no idea of the fire job there is to do up here," they told me. "Here's Alaska with an area of 546,000 square miles, about a fifth the size of the 48 states. And outside the twenty-five-million-odd acres in the Tongass and Chugach National Forests, we're responsible for protecting the whole of it. We get a total appropria-

tion of between 30 and 40 thousand dollars—sometimes not that much. You can see what we're up against."

"Yeah," I replied, "but I've flown over much of the country and there must be a whale of a hunk you don't have to worry about. And besides, I can't see much need for spending a lot of money protecting any of it. As far as I can see all the good and accessible timber is along the coast in the national forests. What do we lose if this back country does burn over?"

"Look," said Bill, "you like to hunt migrating birds don't you? Well, this is where your migratory birds come from. They nest up here and when those nesting grounds burn over as they do, the answer is obvious—fewer birds."

F–17989A

Old burn in hemlock and spruce, Skagway Valley, Alaska.

"Sure," Robinson backed him up. "You've flown over a big area and you've seen a lot of rock and muskeg country that we don't have to worry about, it's true. But there's more of it you haven't been over. You haven't been up in the interior around Fairbanks. There's some good timber up there too, and timber means a lot to the isolated people mining and trapping and developing that area.

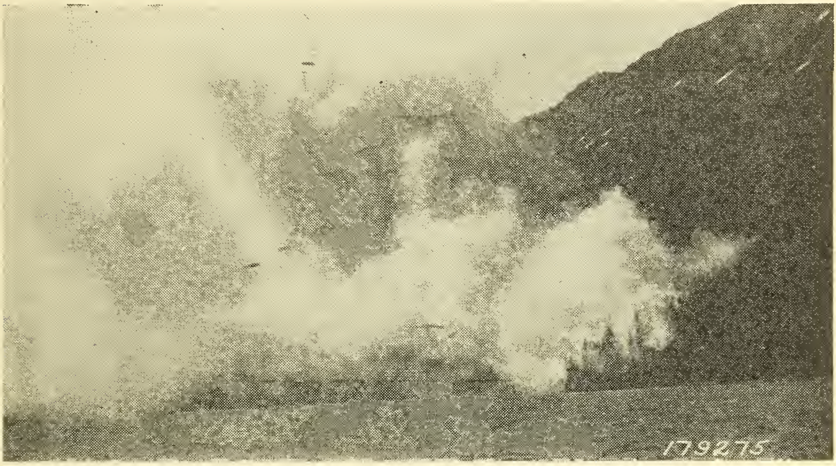
"Then take the case of the reindeer range. Reindeer are mighty important up here for meat and hides for the Eskimos and white population too. They're suitable for export, and the day may come when there'll be enough of them to make an important industry. But that'll never happen if we continue to let the range burn. A good stand of reindeer moss doesn't spring up over night. It's slow growing—a good thick growth takes years. But she burns just like grass once she gets started."

"Yeah," wound up Bill, "and don't think fires don't get started and don't burn. They start in the spring and burn all summer. Cover

thousands of acres every year. And we can't even spot 'em. We've got to depend on reports from prospectors or whoever happens to be in the country to know about 'em. Sometimes they burn for weeks before any word ever gets out to us.

"The only way we can get to 'em is by plane and we've got no planes. Once we get to 'em they're too big to handle with the few men we can hire to fight 'em. With our little money all we can do is hammer away at prevention.

"You go back to the States and tell 'em we've got a fire control problem up here that's a dinger. Tell 'em we've got to have more money, more equipment and specialized equipment, more manpower. Especially tell the sportsmen—they've got an immediate interest."



F–179275

Forest fire on Chugach National Forest, Alaska.

So it went. I heard about fires and saw evidences of past fires in Alaska. And on the way outside in middle September I had an opportunity to actually fight two fires where you'd least expect to find them—in the heavy rain forests along the southeastern coast.

After a day's run in the Ranger 8, one of the fleet of Forest Service boats, we were cruising in to a late anchorage in one of the countless small coves. Fred and I were in the galley cleaning up the evening meal dishes, and Fred was looking out of the shore-side porthole.

"Hey," he said suddenly, "look across there—there's a fire."

Taking a look I could make out a dim illumination. "Maybe it's just a beacon of some kind," I said. "I'll go up in the wheelhouse and take a squint through the glasses."

Up in the wheelhouse Skipper George Reynolds and Harry Sperling of the Juneau office had already spotted the light.

"It might be a gas boat on fire close to the shore," said Harry.

"Too high," said George.

"How about a settler's cabin?" I asked.

"Nobody along this part of the coast that I know of," replied George.

We were nearer now and daylight was growing very dim. Flames suddenly broke out brightly and raced up almost to the top of the shore line trees. "Just like fire going up into the crowns of a piece of timber," I thought. And then it dawned on me.

"That's what it is," I said. It's a fire in the timber."

Both George and Harry laughed. "You're in Alaska now, fella," said Harry. "It's a little different up here than down in western Montana."

Not long after, however, they incredulously came to agree with my opinion. Anchoring a safe distance offshore we put the dingy over and with pump, hose, shovels, Pulaski tools, and axes rowed in to a landing. Pushing through a dense growth of shore grass, head high and reeking wet, we emerged suddenly at the edge of the conflagration.

Under the thick canopy of great spruce trees the fire had caught the dry matting of needles and spread over about a tenth of an acre. The shooting flames we had seen was a run of fire up through the branches. With the exception of this one catch, which had been of brief duration, the crowns were apparently impervious. At the base of one of the trees were what we took to be the remains of a campfire—apparently how and where the blaze started.

Setting up the pump and coupling together enough hose to reach all parts of the fire required but a few moments. Among other things loaded into the dingy on leaving the boat, George had included one of the steel folding chairs, out of the galley. This, when set upon the beach, served as an elevated stand for the gas tank, gravity feeding the pump. Because of the corrosive effect of salt water, pumps when not in use are kept thoroughly capped and filled with oil.

Within less than an hour all visible sparks had been doused with brind from the Pacific. Mopping-up was left for the morning. Since the fire had obviously been smouldering for several days before actually breaking out in the open, it had become deeply established under roots and rocks, which called for considerable digging and hacking.

Additional atmosphere and interest was furnished the evening's engagement by a school of whales frolicking just offshore. Over the hum of the pump motor the spouting of these animals sounded like an engineer letting steam out of a locomotive. This type of cheering from the sidelines, I am told, is a fire-fighting feature infrequently encountered and exclusively Alaskan.

Hardly had we again got under way after dispatching this fire than another was sighted. Except that it was smaller and of more recent origin, this second fire in all respects was identical with the first. About 2 hours was all that was required to drown and dig it out completely. A driftwood board set up at one end of the beach near the fire had been shattered with bullets. At the opposite end of the beach we found a number of empty .30–06 cartridges, establishing this as a hunter's fire almost unquestionably.

I am not generally credited as a scientist nor do I by any manner of means represent myself to be one. That my investigative technique

in this instance might have been faulty and incomplete is quite likely. But to me the dictum is clear: Fire fighting is a disease as unshakable as a bad habit.

Two fires in two days in the heart of Alaska's swamp utopia leaves nothing more to be answered. Recognizing my fate I resign myself to fire fighting unconditionally and regardless, wherever I may be.

STREAMLINING THE R-2 FIRE-DANGER METER

(Continued from page 85)

In operation the pointer above the FUEL MOISTURE STICK scale is set at the FUEL MOISTURE STICK reading and so on until the RELATIVE HUMIDITY reading has been set. Just above the CUMULATIVE EFFECTS scale is a fixed scale and by noting the figure opposite the zero point, the daily cumulative effect can be read. (Unfortunately part of the scale just to the right of the CUMULATIVE EFFECTS scale was lost before the photograph was taken.) Here enters the only mental calculation necessary—the daily cumulative effect is added to the CUMULATIVE EFFECTS figure for the previous day and the pointer above the scale is set and the FIRE DANGER TODAY is read direct. It will be noted that a CONDITION OF ANNUALS scale appears above the left end of the FIRE DANGER TODAY scale. By setting the zero point on the latter opposite the current deduction figure, the deduction is automatically made.

It is felt that this new design is an improvement over the present one, but actual use will be needed to demonstrate this.

458654—42——2

BOY SCOUTS AND AMERICAN FORESTS

Capt. E. C. Mills

National Director, Health and Safety Service, Boy Scouts of America

The playgrounds and workshops of Scouting are the forests, fields, mountains, and waterways of America. Nature forms the back drop against which the great outdoor program of the Boy Scouts of America has been built.

An inseparable part of that program is training in citizenship and the traits of character essential to maintaining the "American way" of life.

"And just what," may be asked, "does such training have to do with preventing forest fires, or putting them out, or of replacing the losses with young trees?"

Before attempting to answer that question, your attention is called to a statement quoted from Scouting's Health and Safety Magazine of August 1939:

> The Boy Scouts of America is interested in the protection of American forests and homes from fire for a number of excellent reasons, chief of which is that it is an American institution dedicated to character development and the training of young men for citizenship. It believes that an educated and trained citizenry conserves its national resources and protects its people. By the same token, it believes that destruction caused by carelessness indicates weaknesses not conducive to strong character building and that the causes of such destruction can be removed through better understanding, training, and the assumption of personal responsibility.
>
> As an organization it has a moral and economic obligation for the magnificient gifts of thousands of citizens which have made it possible for Scout Councils to lease or own more than 160,000 acres of wild land for Scout camps well equipped with facilities for the use of American boys. The value of the properties owned by various councils is close to $10,000,000. The man-made equipment on these sites can be replaced, but the timber and wildlife cannot, except through nature's efforts and then only after many years—if at all.
>
> Is the future of your council's camp property protected as well as is possible, or will its usefulness and the happiness of this and future generations of Scouts be dissipated in wood smoke?

Today more than 1,150,000 boys are registered members, 923,000 of these being Scouts—boys over 12 years of age—divided among 42,000 troops. The adult leader of each troop is the scoutmaster who has one or more adult assistants. The camping program is of great importance to every troop. Between 350,000 and 500,000 Scouts spend one or more weeks at camp each year. Many troops carry on their overnight and week end camping activities throughout the year, weather permitting, and some regardless of weather.

Because the use of fire for cooking, heat, and ceremonies is very important in a camping program, a great deal of training in fire making, use, and extinguishing is necessary. It must be carried on almost constantly by leaders, who, in turn, must have training. Courses for leaders are conducted throughout the year by the 542 Scout Councils into which the country is divided.

Scouting has a special award plan for advanced study in more than 100 different subjects. This is known as the Merit Badge system. One of these merit badges is for "Firemanship." Requirement No. 2 of the 6 which must be passed to win this badge has to do with forest-fire prevention. It reads:

> Demonstrate or submit sketches illustrating two of the following:
> *a.* Proper building of campfire with relation to inflammable material both around and under place where fire is laid.
> *b.* How to extinguish a campfire.
> *c.* Three practical methods of forest-fire prevention.
> *d.* Three simple methods of forest-fire fighting where elaborate equipment is not available.

Boy Scout National Training School students in "one-lick" method forest-fire drill.

In another requirement is found the following:

> Demonstrate (*a*) How to light and discard a match safely.
> In the past seven years 206,800 Scouts have won this merit badge. Another merit badge of particular importance in the protection of forests and wildlife is "Conservation."

This excellent course has to do with conserving wildlife of forest and stream. In studying it, Scouts learn better to appreciate and protect animal life, and this means giving thoughtful consideration to their environment. They soon learn that adequate ground cover means protection for animals and water in rivers and lakes, and that fire destroys it. The necessity of saving timber and replacing that which has been destroyed becomes immediately apparent.

It would be impossible and of little value to attempt even to estimate the number of acres of seedlings that have been planted by Scouts since

the organization's inception in 1911. Planting is a part of the program for every Scout Council. Every Scout is a tree planter and consequently a potential conservationist.

Another very valuable source of training for Scouts and their leaders has been the cooperative relationships with National and State forest authorities.

Scouting believes in the principle of "learning by doing." Giving service is a great educational medium, and Scouts have given service of many kinds, ranging from posting fire prevention signs, distributing pamphlets, notices, and "fag bags," and carrying warning posters in public places, to serving as fire watchers, guards, and fire fighters.

During the past 3 years the relations of the Scouts with the Division of Fire Control of the U. S. Forest Service have been very close, and it is felt that as a result the education of Scouts and their value to their country have been greatly extended. This expansion began with a series of conferences between Roy Headley, chief of the division, and members of his staff and officials of the Boy Scouts of America. These discussions resulted in the publication and wide distribution and use of an article on the "one-lick method of forest fire fighting," written by Mr. Headley; the extensive showing of the motion picture on the same subject; the securing of Forest Service personnel to give technical training in methods; the correction of potentially dangerous conditions existing at Scout camps; the placing of Forest Service members on Scout Council health and safety committees; and the training of Scout executives in methods at the National Training School at Schiff Scout Reservation.

Schiff Scout Reservation at Mendham, N. J., is the National Training School of the Boy Scouts of America. Many training courses are carried on there for leaders, in addition to those for Scout executives. These include, among others, camping, emergency service, health and safety, and aquatics. Each group is shown the "one-lick method" film, and in many instances the men are taken into the woods, equipped with proper tools, and put through the "one-lick" drill.

Since Scouting was developed in our country 31 years ago, Scouts and Scout leaders have been working energetically to prevent and halt the ravages of fire. Tales of effective and oftentimes heroic action in fire fighting are a part of Scouting's traditions. Scouting is an American institution that constantly strives to improve on past results by learning to do things more effectively. Complacency is the enemy of progress. The Boy Scouts of America has never been a complacent organization. IT CAN DO BETTER. IT WILL DO BETTER.

HAVE WE GONE FAR ENOUGH IN THE USE OF AIRPLANES?

James Bosworth

Assistant Supervisor, St. Joe National Forest, Region 1, U. S. Forest Service

The airplane-parachute method of transporting firemen for attack on forest fires was suggested by Forest Service employees as early as 1934, possibly earlier. It has been put to practical test on limited national-forest areas with encouraging results. (Fire Control Notes, April 1940, Technical Report on the Parachute-jumping Experiment, and October 1940, Wings and Parachutes over the National Forests.) The author now advocates an "all out" application of the method on a full national-forest basis, indicating savings in personnel, improvements, and transportation costs, reduction in damage values, and savings in time, which he believes to be possible. In view of the enormous increase in air-mindedness which has grown with the national emergency, the author's plan may rank with other progressive items which may persist to the benefit of society because of untrammeled thinking and courage exercised now by their sponsors.

Parachute smoke jumping, although still somewhat in the experimental state, has proved according to all reports, that such a method of attack on small fires is practical.

Airplane transportation has been developed to such an extent that this mode of travel is about as safe as automobile travel.

Freight transportation by plane is coming into use throughout the country and we have proved to our own satisfaction in the Forest Service that dropping supplies from a plane by the use of parachutes is also practical, if we have the funds to buy adequate parachutes and other equipment.

With these factors in mind, I propose that we select one forest in Region 1 and go "all out" with an experiment in the use of planes and parachutes for carrying on all work connected with fire control. In other words, the forest organization would be so planned that it would operate and function, so far as possible, by the use of planes and parachute jumpers.

Such a forest should be one where the main activity is fire control, where national-forest land or land under paid protection is more or less blocked up, where a flying base could be located within or close to the area, and preferably close to a large town or city.

Under such a plan, detection would be obtained by airplanes patrolling in the forest in a gridiron fashion on strips 12 miles apart, making from 1 to 8 trips per day, depending on the fire danger. Each plane would carry 2 smoke jumpers, 1 observer, 1 pilot, radio, and other equipment.

In comparing detection by air patrol with our regular look-out system, I believe that a plane flying 100 miles an hour, with 4 men watching a strip of land 12 miles wide would give as good, if not

better, detection than our present look-out system, since the observers in a plane would have the advantage of seeing 25 percent more area than is seen by our regular season force. This is on the basis that the observers from a plane could see 95 percent of the area, while our regular season force has a "seen" area coverage of about 70 percent.

The fire-discovery time, however, would be somewhat increased because of the small number of trips per day during low fire danger and the fact that patrol flights would be made only in daylight. The St. Joe records show that in 1940, 18 percent of the fires were discovered between 9 p. m. and 4 a. m. compared with 10 percent in 1941. Personally, this does not worry me for the reason that a great many of these fires are not actually worked on until daylight hours. Furthermore, there are only a very few nights during which a fire will travel to any extent.

During daylight hours it would probably be desirable to arrange the flights so that the last one would be just before dark and the first one just after daylight. It may also be possible to patrol at night, but these are points which would have to be worked out later.

When a fire is discovered on a flight, the plane would go to it immediately and unload the jumpers. In this way, travel and hunting time would be reduced to about 30 minutes or less, compared with the average on the St. Joe Forest of 2 hours 58 minutes in 1940 and 2 hours 31 minutes in 1941, based on 150 and 69 fire reports, respectively—a factor which I believe will more than offset the slower discovery time.

The hazards in parachute jumping may appear to be much higher than for a ground organization, although reports show that so far the only lost-time accidents sustained by our smoke jumpers were two sprained ankles. The indications are that the accident rate is not any higher than would normally be expected in our smoke-chaser travel.

I am not qualified to judge the type of plane best suited for the purpose, but it appears to me that a twin-motored plane would be the safest and most suitable. If this type of plane had been used in the past in our flying, some the serious and near-serious accidents that we have had could probably have been avoided.

One of the most difficult things to work out might be to obtain sufficient parachute smoke jumpers and keep within the fire-control allotments. My solution for this would be:

1. A crew of at least 15 men trained and qualified as smoke jumpers and observers to be held at the flying base to man the patrol flights.

2. At least 10 men to be trained in smoke jumping and employed in accessible crews located on the forest. These men would be paid while training and given a $30 per month bonus to act as smoke jumpers when called.

3. To have the adjacent forests cooperate by furnishing two smoke jumpers each who would be available on short notice near landing fields. These men to be trained and given a subsidy of $30 per month.

4. The air base for the forest should be located at or near the largest city, where it would be possible to obtain up to 40 or 50 men

(volunteers) who could meet the standard requirements, to be trained in jumping and fire suppression and given, for example, $25 per jump and $1 per hour for working time when called. These men could be employed by private concerns at various jobs in the city and arrangements made with their employers to release them when needed. This would be the force from which our overload of fires would be handled.

I believe it would be possible in a town of 5,000 or more to stimulate enough interest in parachute jumping so that men could be obtained under such arrangements. It might be possible, also, to interest the Army to the extent of having them finance the training in connection with the war program, since the candidates might be available as parachute troops.

With such an organization, it should be possible to man up to 40 fires in 1 day. Since this would not catch the peak load on most of the heavy-fire forests, it would be necessary to rely on trail- and road-maintenance men, other crews, and help from other forests as we do now.

In discussing an aerial organization, other members of the Forest Service seem to feel that the peak load of fires on a forest would break down such an organization. Personally, I can't see it, since the regular schedule flights would be made to obtain location even though it was impossible to send smoke jumpers to fires at the time they were discovered. Detection and location would be more regular and at least as accurate as it is now and no more difficulty would be encountered in dispatching men to unmanned fires than exists under our present management.

A break-down is also predicted during smoky weather. Some of the men seem to feel that it would be impossible to see small fires from a plane, but it is my theory that smoke usually lies just over the mountain in a blanket of various thicknesses, and a look-out—in order to see a fire—must look through the smoke blanket horizontally, while an observer flying overhead would look through the smoke blanket vertically or at an angle and would have better visibility. At least the look-out is up against the same visibility conditions as the observer in a plane.

With an "all out" aerial organization on a forest, it would be necessary to make a number of changes since there would be no protection force. The amount of work on a back district would not justify a year-long ranger, and a 6-months alternate could be used to handle public administration, supervise trail-maintenance crews, take care of weather reports, and pick up the parachute jumpers. These men would form part of the fire-overhead organization and should be trained and capable of taking over the fire-boss job on medium-sized fires.

All telephone-maintenance funds except those needed to maintain the main-line circuits could be transferred for aerial use.

Pack stock could be reduced to the actual number needed to handle the progressive trail-maintenance crews during the fire season.

Smoke-chaser and suppression equipment could be concentrated at flying base and reduced considerably.

Elaborate ranger station set-ups, look-out houses, towers, and other fire-control structures could be practically eliminated.

A large reduction could be made in travel time and transportation.

In order to show the possibilities of the experiment, I am proposing, and to clarify it, I will work out roughly a plan for the St. Joe Forest, not that the St. Joe should necessarily be the one to practice on, but because I have some facts and figures to work with. The St. Joe lacks landing fields and the flying base would have to be located near Moscow, Idaho, which would require deadhead travel. Two districts have numerous activities other than fire, and the land under paid protection is not as compact as it should be.

To start with, I have prepared a tabulation showing fire danger each day for the past five seasons and the average number of days for each class of fire danger in order to determine about how many trips over the forest would be needed during an average season. I then assumed that when the fire danger is 2.4 or less no patrol would be needed. From 2.6 to 3.0, inclusive, 1 patrol trip per day; 3.2 to 3.6 inclusive, 2 patrol trips per day and so on until the danger reached class 5+ when 8 patrol trips per day would be flown.

Using 12-mile strips with base at Moscow, Idaho, the round trip distance will be 270 miles. This has been increased 30 miles per trip to take care of extra miles needed to look over suspicious or false smokes and extra trips.

Since the primary job of the rangers on the Avery, Roundtop, Red Ives, and Calder districts is fire control, rangers would be eliminated and replaced with 6- or 7-month alternates. The Palouse and Clarkia districts, because of the numerous other activities would have yearlong rangers and 6-month public contact men. Road maintenance would be supervised from the supervisor's office.

Blister rust control crews would also be handled from the supervisor's office as they are now.

Pack and saddle stock could be reduced 60 percent by handling trail maintenance under the progressive system during fire season.

The clerical force could be reduced 20 percent because of the decreased number of employees, less purchasing, vouchering, and other miscellaneous details.

Equipment could be reduced and concentrated with a saving estimated at about $2,000.

There have been 77 look-out houses and towers constructed on the St. Joe; 30 more are needed to meet the fire plan. Under average season conditions, a total of 107, at an average cost of about $1,500 each, including visibility clearing, amounts to $160,500—assuming a life of 30 years, a maintenance cost of $20 per year each and interest at 5 percent, the annual cost amounts to $15,515.

By replacing the four yearlong rangers with temporary men and practically all the protection force, the headquarters improvement could be almost entirely eliminated on four districts and reduced 60 percent on the other two.

A conservative figure for the cost of a ranger station set-up is about $30,000. On this basis, the total would amount to $156,000. Assum-

ing a life of 40 years, maintenance at $1,600 on all and interest at 5 percent, the annual savings would be $13,300.

An analysis recently made on the forest showed that during the past 12-month period, rangers, alternates, contact men and supervisor's staff spent a total of 2⅓ years driving a car. With a reduced force and travel made on the regular patrol flights, travel time and travel costs could probably be reduced 75 percent.

Summary of Estimated Savings

4 yearlong rangers and expense	$10, 900
Reduction in pack stock	3, 000
Saving in clerical help	2, 000
Saving on equipment	2, 000
Elimination of look-out houses and towers	15 515
Reduction in headquarters, improvements	13, 300
Saving on telephone maintenance	2, 000
Total	48,715

Cost of Proposed Aerial Fire Control Organization

1 yearlong forest officer in charge	$2, 700
1 dispatcher, 6 months @ $175	1, 050
15 smoke jumpers at base	8, 750
10 smoke jumpers, trained and subsidized (on forest)	3, 000
8 smoke jumpers, trained and subsidized (on adjacent forests)	2, 400
40 volunteers, training, etc	8, 000
Annual equipment costs	2, 000
4 ranger alternates, 6 months @ $175	[1] 3, 150
2 contact men, 5 months @ $166	1, 660
Travel and expense	2, 000
843 flying hours @ $25 per hour	21, 075
	55, 785

[1] Paid 25 percent from trail- and road-maintenance funds.

The average annual presuppression expenditures during the past 5 years, including FF E. P., have amounted to $56,900. Thus there would be a slight difference in favor of an aerial organization, but there still remains $48,715 accumulated in other savings based on a long period of time.

In arriving at a cost of $25 per hour for plane service, I assumed that since we are able to obtain planes at $35 under bid now with a limited number of flying hours, we should, by increasing the number of hours, be able to get a cheaper rate and eliminate the stand-by service, if any.

In an average or bad fire season, at least three planes would be required to handle the increased number of trips per day.

I realize that I am proposing a radical plan, that it sounds fantastic, and that most of it is based on theory, but I really believe we have enough sound facts to justify some pretty serious thinking along this line.

We have fire plans in Region 1 that have been estimated to cost $250,000 and so far as I can see they are just as fantastic as the plan I

(Continued on page 102)

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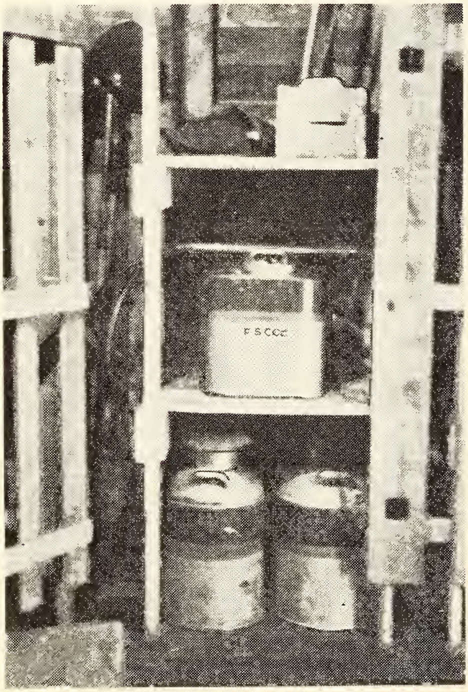
TRUCK TOOL BOX AND STALLS SOLVE FIRE-TOOL CACHE PROBLEMS

WALDO M. SANDS, *Project Superintendent, Camp Wellston, F-68, Manistee National Forest, Region 9, U. S. Forest Service*

At Camp Wellston, on the Manistee National Forest, a new system has been adopted for making up fire-tool caches in preparing stand-by trucks for immediate action and use as first attack and reinforcement units on fire calls.

Trucks at this camp are equipped with a combination tool box and truck seat, which is designed to accommodate all tools, water cans, and back-pack pumps. The closed covers of the boxes make safe and comfortable riding seats for enrollee workers and fire fighters.



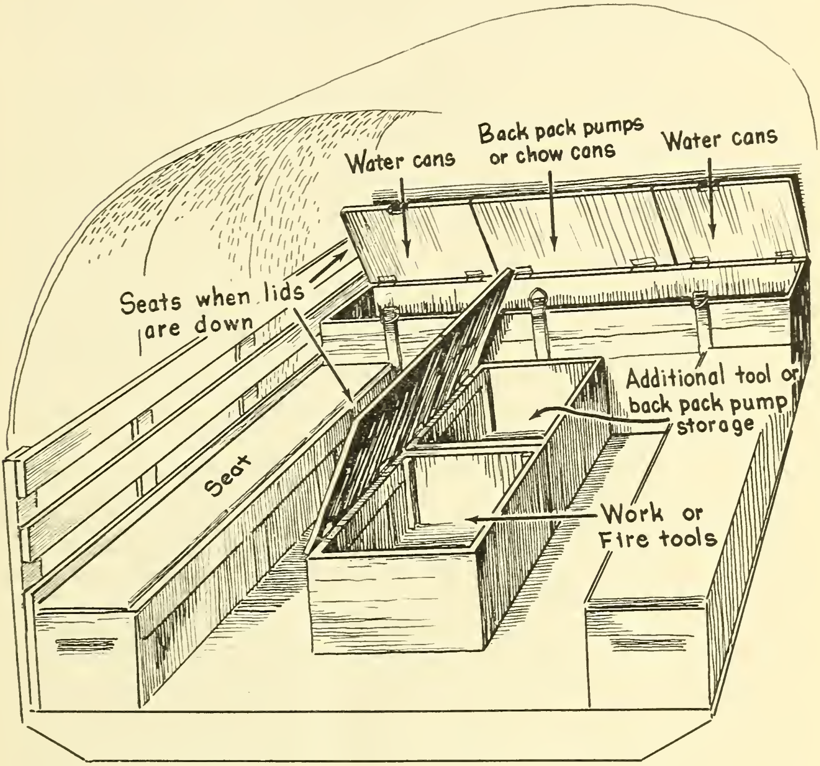
Typical stall in fire-cache building containing fire equipment ready for transfer to fire trucks.

Complications and safety measures have prohibited the efficient use of devices for attaching or anchoring both tool boxes and seats and fire-tool cache boxes on stake trucks. To simplify matters and to save time and labor in removing crew seats, and in loading fire-cache boxes and fastening them down, it was decided to organize and store the contents of all 5- and 10-man caches in separate stalls in the fire-cache building, thus permitting the equipment to be transferred from these stalls to the truck tool boxes very easily when needed. One man can now do the loading, as compared with 4 or 5 formerly needed to remove the heavy seats and install the equally heavy fire-tool boxes.

In the former use of separate fire-tool boxes, only one 10-man unit could be loaded and fastened down, thus limiting the size of the crew and seating capacity, with no provision for safe, comfortable riding of the men and equipment; also, it is doubtful that the heavy cache boxes would withstand the strain of being tossed around in case of accident, as it is necessary to place them in position on the truck floor

and fasten them down with the same fasteners that are used to hold the regular crew seats.

Normally a stand-by fire truck loaded with a 15-man fire-tool cache is maintained and stationed at Camp Wellston throughout the fire season. When this truck is dispatched to a fire, it is a comparatively simple job to back up another truck in front of the equipment stall in the fire-cache building, break the seal on the 5- or 10-man fire-tool cache stall, or even two or three stalls, and transfer the equipment to the combination crew seat and tool box on the truck.



Tool boxes installed in truck body, with lids open.

Increasing the carrying capacity of each individual truck reduces transportation and other important costs, principally through the reduction in the number of trucks sent to a fire, thus allowing the extra trucks to be equipped and used on emergency stand-by and elsewhere. Also, with the present war emergency, more economical use of trucks is desirable.

This method of loading and transporting fire-cache tools during the 1941 fire season was satisfactory and efficient. No difficulty was experienced in maintaining equipment after a fire, as the equipment was inspected, reconditioned, and placed in its proper place in a numbered and sealed stall until needed again. Another advantage was use of the wall space for the cache stalls, which were divided into an upper

and lower compartment for various sized tools. The floor was clear of miscellaneous items and each stall was accessible for each inspection checking and inventory.

Advantages of the cache-stall system over the fire tool-box system are as follows:

1. Facilitates loading and unloading operations.
   a. Reduces accidents caused in handling heavy fire tools and back-pack pump boxes.
2. One tool box is used for two purposes.
3. Permits secure attachment of tool box and seats to truck bed.
4. Minimizes risk, and has added safety features in case of accident.
   a. Provides safe and comfortable means of riding.
5. Speeds dispatch, and permits more men and equipment to go to a fire in a single truck.
6. Reduces transportation and many other important costs in fire control and suppression work, by reducing number of trucks required.
7. Increases general utility of storage building by providing more available floor space.

HAVE WE GONE FAR ENOUGH IN THE USE OF AIRPLANES?

(Continued from page 99)

propose here. As an example: Last year we started out with a loss of about 45 percent of our old experienced men. We managed to fill these vacancies, trained the men and another 40 or 50 of our best men, and wound up the season short-handed and with a number of inferior fire-goers. Fortunately, we had one of the easiest fire seasons most of us old-timers have ever seen.

Suppose next year we have a fire season that demands a class 5 5 organization. Our fire plan shows that we need 177 detectors and fire-goers and 40 overhead. That's 112 more men than we had last year. If we couldn't get them last year with 600 B. R. C. men to pick from, what are the prospects? If, in the next year or two, we should get a season rated 6.7 danger class, the quarter-million-dollar fire plan would show the St. Joe needing 342 fire-goers and 41 overhead, plus an enormous amount of equipment and supplies which we would be unable to obtain.

FIGHTING PRAIRIE FIRES IN THE NEBRASKA SAND HILLS

Donald W. Smith

District Forest Ranger, Nebraska National Forest, Region 2
U. S. Forest Service

From articles appearing in the July and October issues of the 1940 Fire Control Notes, it is apparent that other forests and foresters have grass-fire problems and are working on applicable suppression techniques. Most fires on the Nebraska National Forest are grass fires, and 39 years of study and fire fighting by past and present personnel have developed several worth-while practices.

The so-called Austin rotary organization or "spinning firemen" technique, wherein fire fighters move along a line of fire in a rotating circle, has been in use in this vicinity for a number of years. Many local ranchers through years of experience in fighting prairie fires had developed the art of sand throwing to a high degree, and when working on fires in small groups, they frequently fell into a revolving circle as they worked along the line. Both the sand-throwing practice and the type of crew organization were picked up from them and developed into a planned method of fire fighting with the advent of CCC crews on the Nebraska. Our method is similar to that described in earlier (Fire Control Notes) articles in all but one respect. We start out with larger crews, as many as 12 men, in order that extra men will be available for patrol and mop-up along extinguished fire line. By advancing extra men in the crew and dropping them as needed, they can be located by the man in charge of the suppression crew. At the same time, these men assist in control work as they move around the fire into position.

The job of throwing sand along a line of fire is an art in itself and is quite different from an ordinary shoveling job. A short, D-handled, round-pointed shovel is preferred. Among local ranchers, the technique of throwing sand for maximum effect varies a great deal with the individual. Most of them can wield a D-handled shovel equally well either right- or left-handed regardless of whether the fire perimeter is to their right or to their left, and can reverse their hold to avoid undue strain. For maximum force in a narrow radius the best working position is different than for maximum scatter over a wide arc. For CCC use the techniques involved are taught as a standard set of motions. Flames along 10 to 12 feet of the perimeter of a running fire can be knocked down by a single shovelful of sand properly thrown.

Backfiring, or the burning of barrier strips ahead of a fire, is, of course, a most important method, too, in combating fast running, dry grass fires. We use a simple and inexpensive kerosene torch for this purpose. It consists of ⅜-inch tubing fastened to a small gate valve on a 1-quart can. The tube is nearly filled with a cotton wicking and the can is filled with kerosene through a cap on the opposite end from the tube. The valve is opened so that kerosene soaks the wicking and slowly drips. With this simple torch, a man can set grass fire as fast as he can walk.

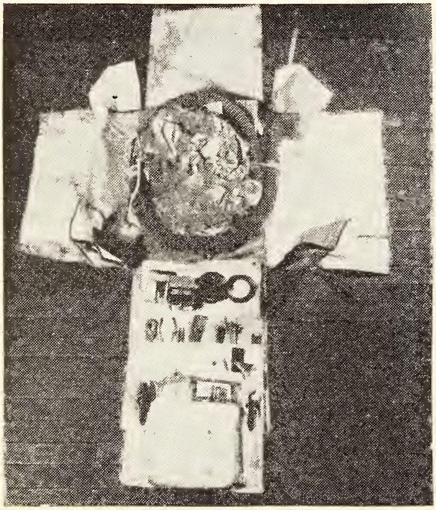
THE ROUTT PUMP ACCESSORY PACK

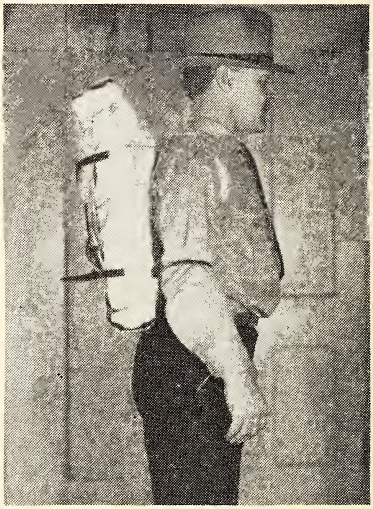
Samuel W. Orr

Forest Ranger, Routt National Forest, Region 2, U. S. Forest Service

For some time it has been felt that a back pack was needed in which to transport the essential tools and accessories necessary to place in operation the type Y Pacific Marine pump used on this forest.

First experiments along this line were undertaken in 1940. About a year ago, in 1941, a model pack was made of scrap material picked up around headquarters. The results were encouraging, so a request was made for funds with which to make a serviceable pack. These funds being granted, the pack illustrated in the accompanying photographs was made up.





Fire-pump accessories assembled, ready for packing. Canvas container packed with fire-pump accessories.

The illustrations describe the pack better than words can do, except for a few details which are not apparent from the photographs. The body of the pack is made of 15-ounce canvas, carrying straps are of 4-inch pack-cinch material, and all leather used is grade A. The two heavy pieces attached to the back of the pack are of the heaviest leather obtainable locally. The weight of the pack without the contents is 4½ pounds and with the contents it weighs 40 pounds. The outside dimensions when packed are 4 by 15 by 22 inches. Contents of the pack are as follows:

50 feet 1½-inch linen hose.
1 1½-inch nozzle with 2 extra tips.
1 8-foot suction hose.
1 suction strainer.
1 6-inch stillson wrench.
1 6-inch crescent wrench.
1 spaner wrench.
1 magneto wrench.

1 pair slip joint pliers.
1 pair large pliers.
1 emergency ration.
1 first-aid kit.
1 canvas bucket.
1 piece sash cord, 12 feet long.
1. headlight with 3 batteries.
1 starting rope for engine.
2 extra spark plugs.
3 extra headlight batteries.
1 screw driver.
1 coil stovepipe wire.
1 engine record book.
6 rubber hose washers.
1 6-inch machinist punch.
1 packing gland wrench.
1 spark-plug gauge.
1 check and relief valve.
¼ pound rags.
1 can cup grease.
1 pencil.
1 box pencil leads.
1 notebook.
1 set instructions.
1 2½-gallon water bag.

In making up the pack, straps and buckles were used rather than snaps and rings, as was suggested, because the pack must be cinched up tight in order to carry well, and this could not be done with snaps and rings. Also snaps have a tendency to break easily. At different times during the process of construction the addition of a tump line, belt, and breast strap was suggested. All of these suggestions were rejected for one reason or another. However, if any of these features are needed they can be added at small cost.

The addition of a small hand ax to the pack seems desirable. Often an ax can be used to advantage in placing the pump, or while traveling through the brush to the site of the fire. I would recommend a single-bitted hatchet similar to that turned out under the "Marble" tradename. This hatchet should be carried on the outside of the pack in loops where it would be easily accessible without opening the pack. Probably the best place for it would be on the side of the pack behind the left shoulder. In this position, it would be a simple matter for a man to reach over his left shoulder with his right hand and withdraw the hatchet and go to work. A single-bited hatchet is recommended because it could be used as a hammer and thus the extra weight of a hammer in the pack would be eliminated. The 50 feet of hose is included to be used at the working end of the hose line. How often it has happened that the first 100 feet of hose has come back from a fire full of holes, usually because the hose has been dragged over the ground by the nozzle man. Since the working end of the hose line must be moved around more or less, it seemed more economical to wear out a 50-foot length rather than a 100-foot length. This hose also acts as a cushion to keep the hard objects in the pack away from a man's back.

In arranging the pack, various methods were tried with the idea of securing a well-balanced pack. The method finally selected provided that all the heavier objects should be placed in the center of and towards the top of the pack. This method of packing resulted in throwing the center of gravity well up on a man's back at just the proper point for easy carrying.

The items included in the pack are those which we feel are needed immediately, to get the pump working and to keep it working until additional equipment can be brought up. However, the contents can be varied to suit local conditions. It should be borne in mind, though,

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RECREATION GROUPS ON THE FIRE FRONT

ROBERT S. MONAHAN

Information and Education, Washington Office U. S. Forest Service

Recreation visitors are traditionally classed as fire risks. Does not our present extensive system of recreation improvements stem back to the belief that such visitors were two-legged firebrands who must be corralled in fireproofed areas?

Responsible leaders of outdoor organizations have always been sensitive to this blanket indictment. They seem to have recognized 1942 as the year when they can demonstrate the fire-consciousness of their followers not only by an effective prevention campaign but also by what is even more timely—an organized fire-fighting auxiliary.

Reports originating from all over the country emphasize the sincere desire of recreation groups to bolster regular suppression personnel. The Pacific Camping Association at its annual meeting studied suggestions for training fire suppression squads from camps of older groups.

In a special appeal to its 300,000 subscribers, the editors of Outdoor Life declared:

> The Forest Service still has trained and experienced leaders and modern equipment, but it is dangerously short of manpower. * * * Sportsmen's organizations and individual sportsmen who are willing to give their efforts and some of their spare time to helping to protect our national forests against fire during the war are asked to write to the supervisor of their nearest national forest. * * * If you can't do your bit on the firing line, do it on the fire line!

The Portland Oregonian struck a responsive chord when Bob Webb, a staff writer, challenged his outdoor colleagues:

> You have long felt a debt of gratitude toward the Government that opened these areas for your recreation and toward the men who have protected the forests against their greatest enemy—fire! You can repay that debt by joining the newest of the important home defense units, the Forest Service reserves.

Fred H. McNeil, one-time forest guard and now night editor of the Oregon Journal, addressed a stirring appeal, We Can Help Some More, to the Ski Bulletin, official publication of the National Ski Association. Writing as the first vice president of that far-flung organization, McNeil concluded his plea:

> The foresters have done much for mountain sports, winter or summer. They have come to our assistance so often in the extremity of a tournament crisis or in helping us get established in new skiing centers. So now, in a dire time, we can aid them.

Skiers are particularly well adapted to fire fighting. At the drop of a hat they are on their way whether it's a report of "new powder on Baldy" or "forest fire up Sandy." The average skier's outfit is a veritable depot of outdoor necessities. His womenfolk are a hardy,

resourceful crew. And in the summer, unlike many other potential fire fighters, his muscles and lungs conditioned from a long winter season of vigorous exercise, are ready for action.

Officials of ski tournaments, familiar with adjusting split-second differences in competitors' times and spelling the names of Scandinavian contestants, should have little difficulty in preparing time reports. With uncanny sense of grade and personal knowledge of mountain terrain, cross-country skiers should be well qualified as smoke chasers. In fact, there is a place to utilize the varied capabilities of experienced skiers in every forest-fire organization plan.

These spontaneous offers from recreation groups have received the equally sincere acceptance of forest-protection agencies. Fire plans have been revised to give such volunteers the opportunity they deserve. But to be truly effective when initial enthusiasm may have waned, such cooperative understandings must be based on strong organization, positive commitments, and dependable obligations.

As Roy Headley put it, "I am confident that the readiness of cooperators to cooperate will not outrun Forest Service readiness to welcome, organize, train, and utilize their help."

THE ROUTT PUMP ACCESSORY PACK

(Continued from page 105)

that every piece of equipment added increases the weight of the pack, and weight is what we have tried to cut down. It is possible to reduce the present weight of the pack a pound or so by combining some of the tools contained in it into one tool, such as the 6-inch crescent and 6-inch stillson wrenches, the spanner wrench, the packing gland wrench, etc. The pack might be improved by using narrower material for the shoulder straps. It has been suggested that the edges of the straps as they now are might have a tendency to rub a man's shoulders. I have used 4-inch material, but 3-inch would probably be better.

All points of the pack which are subject to severe strain are double-sewed with harness thread and, in addition, are riveted with copper harness rivets. The heavy pieces of leather on the back of the pack, referred to elsewhere, were placed there to act as stiffeners and to hold the pack to shape.

458654—42——4

THE CYPHER HAND-OPERATED PICK-UP FIRE PUMPER

RALPH D. CYPHER

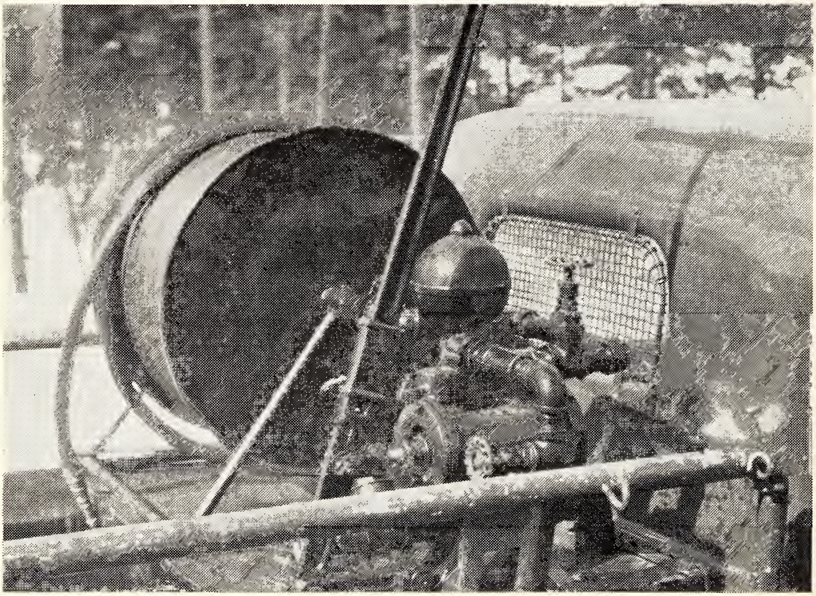
Project Superintendent CCC Camp, Sheridan F–24, Harney National Forest, Region 2, U. S. Forest Service

After observing the embarrassment of inexperienced operators attempting to start various types of temperamental power pumps and the numerous fires on which it has been impracticable to get pumpers on first attack, the idea of a small hand-operated pump that could be mounted on a pick-up and moved easily from pick-up to pick-up was considered. With this idea in mind experiments were started.

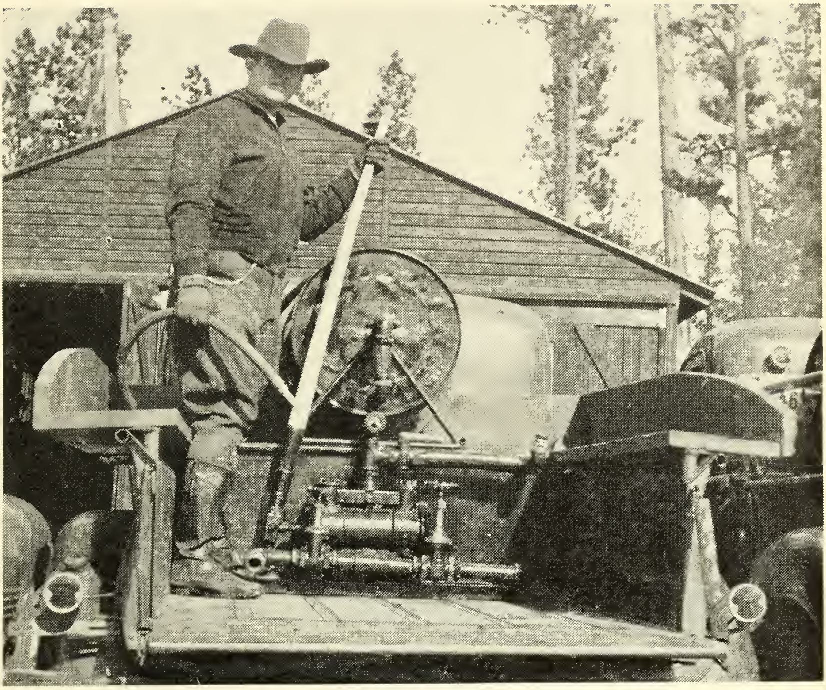
The first pumper built and still in use was made with an ordinary thresher pump mounted on a tank of 90-gallon capacity.

This outfit worked very successfully on first attack on small fires. Usually in the Harney Forest, it is possible to drive directly to the fire and in controlling lightning strikes and fires resulting from such strikes, the pick-up pumper is very valuable. It is easily operated by one man on the pump and one on the hose.

During the winter of 1941–42, two more units were constructed at a cost of less than $50 per unit. Pressure pumps of similar design to the thresher pump, but more easily operated and more efficient, were used.



Portable hand-operated water pump constructed from a used threshing machine unit.



Portable hand-operated water pump of later model.

Tanks of various capacity and shapes, partly for experimental reasons and partly because of necessity, have been used in connection with these pumps. At present, tanks of 90-, 85-, and 80-gallon capacities are in use.

A live reel, constructed from the ends of an oil barrel and a grease drum mounted on a frame of ½-inch welded pipe, carries 200 feet of 1-inch hose. This length of hose seems to fit the local situation in the most practical manner, although more or less may be used.

The tank may be filled by the pump from any source of water, such as a pond or creek, and each unit carries 20 feet of 1½-inch hose for this purpose. The tanks in use can be filled in about 3 minutes and the water supply will last from 20 to 30 minutes where a ¼-inch nozzle is used.

The entire outfit when loaded weighs less than 1,000 pounds and can be taken anywhere a pick-up truck will go. The hand pumper is not designed to compete with motor-driven pumps now in use. Its primary purpose is to fill a need for a light first-attack unit that is cheap, easily built, and operable by anyone regardless of experience, and that will deliver an amount of water sufficient for normal first-attack purposes.

EXPERIMENTS WITH FIBROUS WATER HOSE

Glenn C. Charlton

District Ranger, Williamette National Forest, Region 6, U. S. Forest Service

In this article the author described a fibrous water hose of very light weight and low cost, easy to extend over forest terrain, and of sufficient strength to deliver water by gravity flow over long distances in quantities practicable for use in controlling and mopping-up forest fire areas.

The purpose of the experiments described was to develop a light hose for conveying water by gravity to points where it can be used in fire-suppression work. In order to be practical, the hose must be strong enough to withstand the pressure developed when it is run over uneven ground and across shallow depressions or over logs and other obstacles normally encountered when laying out a gravity system; light enough to enable one man to carry several thousand feet over rugged mountain terrain; durable enough to outlast the life of an ordinary fire; and so packaged that it can be laid out at a high rate of speed.

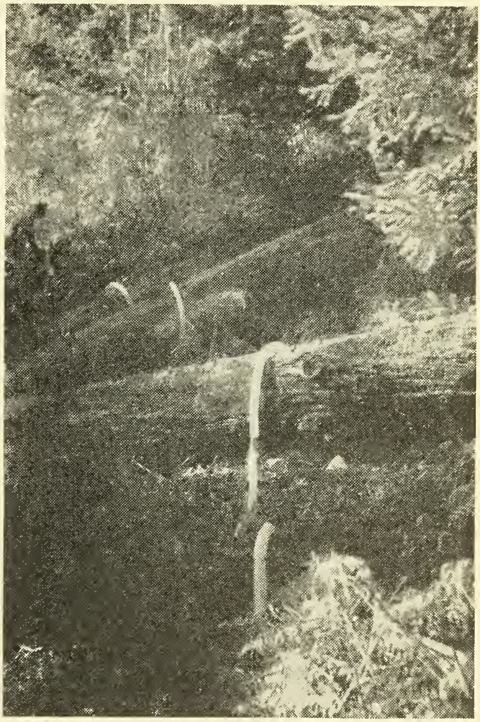
The Visking Corporation, of Chicago, has developed a casing under the trade-name "Fibrous Sausage Casing," which they use as a covering for all kinds of sausages. It is a transparent casing made from sheets of fibrous and chemical cellulose glued together with a waterproof glue. To date, it is manufactured in 3 sizes, approximately 1½ inches, 2 inches, and 2½ inches in diameter. All sizes are made from the same weight and grade of paper. The casing comes in random lengths that vary from 50 to 500 feet. The company has stated that they can develop a process that would produce 500-foot lengths and by gluing these together, they could give us a continuous casing of any length desired. The 1½-inch casing weighs 11 pounds per 1,000 feet, or 58 pounds per mile. The 1½-inch cotton-jacketed rubber-lined hose commonly used weighs 320 pounds per 1,000 feet, or 1,689 pounds per mile.

The fibrous casing costs $0.00648 per foot or $34.21 per mile. The cotton-jacketed rubber-lined hose costs about $0.202 per foot or about $1,066.56 per mile.

The experiments with the hose began with the pressure testing of some 5-foot sample lengths furnished by the manufacturer. The test on the 1½-inch casing showed that it had a breaking strength of about 12 pounds per square inch. The breaking strength of the two larger sizes was much lower, and further experiments were not carried on with them. The next step was to purchase 500 feet of the casing and lay it out under actual field conditions. The site selected made it possible to secure a 60-foot fall in 400 feet. The ground cover consisted of slashing left from a cutting of cedar poles, which which the limbs had been lopped but the slash had not been burned, and which offered unusual opportunity for puncturing the

hose. Logs and other obstacles were crossed where encountered, and no special attention was paid to where the hose fell on the ground. At the end of the 400-foot length, the hose was strung uphill 100 feet for a total vertical raise of 26 feet. All the water that could be forced into the hose through a regular sump bag was then turned in. The hose was checked daily for 3 days and every week thereafter for 4 weeks. At the end of 21 days, there was no apparent deterioriation, but on the twenty-eighth day it had ruptured at the low point. The break was repaired, but numerous small holes were found throughout the entire section that was under pressure, and new ruptures occurred when an attempt was made to raise the water to the original height of 26 feet.

Additional hose was purchased and numerous tests were made during the summer to determine its breaking strength. It was found that rupture occurred when an elevation of 28 to 29 feet above the low point was reached. When the hose was stretched between two logs, the weight of the water, combined with the internal pressure, lowered the breaking pressure in proportion to the distance the hose was suspended above the ground. Very little trouble was experienced with puncture from sharp sticks or rock, and with ordinary care this trouble can be practically eliminated. When the hose was strung over very uneven ground across logs and other obstacles, it was necessary to leave about 1 foot of slack for every 4 feet of horizontal distance in order to compensate for the extra length required when the water-filled hose sank into all the depressions. On fairly smooth slopes it is not necessary to leave additional slack.



Fibrous water hose line laid over logs.

A final test was made in the fall of 1941 with casing that had been in storage for 4 months to determine the loss of strength from deterioration and the effect of friction on 800 feet of hose, and to measure the volume of water in gallons per minute that could be forced through the hose under certain conditions. The test was made on ground where conditions were more severe than will ordinarily be encountered when the hose is used on fire.

The route followed by the hose line was divided into stations and the distance and difference in elevation were determined for each station.

Distance between hose line stations and difference in elevation

From station	To station	Distance [1]	Difference in elevation	From station	To station	Distance [1]	Difference in elevation
		Feet	*Feet*			*Feet*	*Feet*
A	B	79	−40.0	F	G	66	−15.0
B	C	66	−22.8	G	H	132	+4.0
C	D	59	−0.7	H	I	50	+2.6
D	E	50	+16.5	I	J	50	+24.0
E	F	53	−1.5				

[1] The distance between stations represents the shortest distance between them, not the actual length of hose used.

The difference in elevation between the outlet and intake was 32.9 feet, and between the low point and the outlet 30.6 feet. The latter difference is about 2 feet more than that which was used in former tests and indicates that the hose had not deteriorated in the 4 months it was in storage. Friction was also too low to make a noticeable difference as the hose ran flat down the hill to a point approximately level with the outlet. After the hose was tested for breaking strength it was leveled off so the outlet was 26 feet above the low point, and all the water that the sump would hold was turned in. The sump bag was suspended so there was a 2-foot head of water above the actual intake of the hose. The rate of flow was checked at the outlet several times and found to be 17.6 gallons per minute.

As the hose is received in random lengths and also because it is sometimes necessary to repair a break, a light coupling made of 12-gauge sheet metal was designed. It consists of a straight tube slightly smaller in diameter than the hose and has two corrugations on each end. A Y connection was also designed so that water could be diverted in two directions if necessary. The amount of water in each branch can be regulated by tying a string around the hose about 1 foot from the connections and tightening the string until the desired flow is obtained. The hose is fastened to the connections by slipping the ends over the tube and tying with a small but strong cord. A suitable reel for stringing the hose can be made similar to the reel used for stringing emergency telephone wire. A more suitable reel, however, is one made similar to the front forks on a bicycle with a handhold fastened on top. This type of reel gives the man stringing the hose a better chance to place it in the best locations and makes it easier to put it under logs or over the top of other obstacles. Since the 1,000-foot rolls weigh 11 pounds and are only 12 inches in diameter a large or strong reel is not required.

The storage of the hose does not require special facilities. Instructions from the company are to store in a cool place where it does not get wet but at the same time does not dry out. Storage in a basement away from steam pipes is considered satisfactory. Hose used on fire can be drained, rolled, and moved to a new location a

number of times provided that the periods between use are not more than a day or two. It does, however, deteriorate rapidly when subject to wet and dry conditions, and salvage is not recommended when the date for future use is uncertain.

An inquiry sent the Visking Corporation in regard to the development of a stronger casing resulted in the manufacture of a slightly smaller and heavier casing. This casing withstood the pressure of a vertical column of water 39 feet high. It will weigh about one-third more, but since only 100 feet were manufactured its cost could not be determined. The Visking Corporation feels that an order of 100,000 feet would be necessary in order to justify tooling-up to make the heavier casing.

Fibrous water hose, gravity intake, and connections.

The hose does not have sufficient strength to permit use on any kind of pump system. For gravity systems it can be used to replace the regular hose wherever the outlet is not more than 28 feet vertical above low point. If pressure is needed the light hose can be run into a sump, and a power pumper with a short length of regular hose used. It can also be used to carry water to a location above the point of use and connected to the regular hose for developing pressure for gravity mop-up. Its use to carry water close to the point where mop-up is being done with pump cans will often eliminate the long pack necessary under present conditions. Another planned use is to have special smoke chasers carry it out to small fires in well watered country to expedite the mop-up.

The results of experiments carried on at the district ranger station during the past summer may be helpful to those planning to use the hose on fires. The materials needed are a sump bag with the male end of the connection from regular bhose fitted into the lower corner, a female connection of the type used for making emergency repair of regular hose in the field and which has a corrugated projection about 3 inches long, light sleeves, Y's, and a ball of small but strong twine.

Although one man can string the hose at a high rate of speed, two men can more than double the length strung out in any given time. The first man starts stringing the hose at the point of intake, while the second man places the sump bag and makes the necessary connec-

(Continued on page 123)

FIREBREAK PREVENTS LARGER FIRES

A. J. Wagstaff

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Steep slopes with flash fuels have been the scene of a number of large and rapidly burning fires, usually man-caused, in limited lower portions of the slope areas frequented by persons in travel and other activity. The author has indicated one effective method of isolating the greater portions of the inflammable slope areas from the limited lower danger zones and confining man-caused fires to these limited portions with resulting reduction in area burned, suppression costs, and damage.

In the spring of 1935 an addition was made to the Uinta National Forest, the new area extending from the valley floor above the cultivated fields at an elevation of approximately 5,000 feet to higher country some 3 miles distant at elevations of 8,500 to 11,000 feet. The vegetative cover consisted of a belt of cheat grass (*Bromus tectorum*) at the lower elevations, gradually merging into oak brush, with aspen and smaller patches of alpine fir and Douglas-fir at the higher elevations.

The cheat-grass belt at the base of the mountain presented a new fire problem, which was accentuated after the area was added to the forest. Watershed protection was of first importance, so the land previously grazed was given total protection, which resulted in the growth of a rank vegetation.

The cheat-grass belt remains very inflammable from the time the grass seeds start to ripen in early June until late October, depending upon the amount and frequency of precipitation. The annual normal rainfall over this area is 4.82 inches from June to October, inclusive.

There are no data available to show the number and size of fires previous to 1935, although fires were common occurrences.

Through the 5-year period of 1935 to 1939, however, 25 fires occurred on the area under discussion, which burned over 1,222 acres of important watershed land, costing $1,080 to suppress, with an estimated damage of $1,222.

During this time a CCC camp was located near the area and most of the suppression was done with CCC labor. Otherwise the suppression costs would have been much higher. Also it is reasonable to assume the CCC boys put the fires under control faster than a crew of civilians could have done, considering time in recruiting and previous training, which all resulted in smaller fires.

Under extremely dry conditions these fires spread very fast. Some of them have actually traveled ½ mile in 10 minutes. It was observed that trails and small openings in the grass, if they occurred before the fire reached the brush type, often controlled the bounds of the fires.

Most of this area is near U S 91 with its heavy travel load. Also the cities of Provo and Springville, with a population of approximately

25,000 people, are adjacent to the area. The human element of fire hazard is therefore high, and all fires have been man-caused.

It was thought that if fires could be checked before reaching the steeper part of the mountain, the large fires would be prevented. With this in mind, it was decided to build a firebreak, which was done in the early spring of 1940.

The firebreak was located as near as possible around the old Bonneville Lake terrace, which forms a small bench and makes construction less difficult. This location is generally at the foot of the steeper mountain but above the areas where the fires ordinarily start.

A caterpillar tractor with bulldozer and a grader were used, and the cost amounted to approximately $20 a mile. The width of the break is 8 to 9 feet, or just wide enough for the tractor. Ten miles of this type of break were constructed. No car travel is permitted over the break.

A section of the firebreak located at the base of the steeper part of the mountain.

Maintenance is not difficult and requires but one annual trip, before the cheat grass starts to ripen. The cost runs from $2 to $3 a mile.

While the break has been in use for only 2 years and one of these was the most favorable in precipitation known, it is believed the break was a good sound investment.

During the 2 years of operation, 10 fires have occurred, burning 24 acres with a suppression cost of $90 and a damage estimate of $50. The number of fires the past 2 years has averaged the same as the previous 5-year period, with the average acreage burned one-twentieth of the 5-year average.

The 5-year suppression cost average is slightly higher than the total construction cost of $200. The savings over suppression costs the past 2 years have paid for the break nearly twice. The damage costs are likewise low as compared with the 5-year average. A direct comparison follows:

Suppression and damage costs, compared with cost of constructing new firebreak

	Number fires	Acreage burned	Suppression costs	Damage estimates
5 years, 1935–39, inclusive	25	1,222	$1,078	$1,222
Average	5	244	215	244
2 years (after break constructed) 1940–41:				
Total	10	24	90	50
Average	5	12	45	25

(Continued on page 127)

FIRE TRUCK WITH CHAIN MESH AND ASBESTOS MAT DRAGS USED ON THE BLACKFEET INDIAN RESERVATION

Henry F. Wershing

Associate Range Examiner, Districts 3 and 4, U. S. Indian Service

A fire truck equipped with the chain mesh and asbestos mat drags has been used successfully for the past 3 years in the control of grass fires on the Blackfeet Indian Reservation. Its origin dates back many years. During the early days in the western plains the control of grass fires received very little attention except when they threatened ranch property and livestock. It was then a common practice to use two saddle horses to drag over the fire a wet blanket or other material, such as a green hide, or even a freshly killed animal split down the middle. This method has been mechanized by the use of chain mesh and asbestos mat drags attached to a truck.

Several men have had a hand in the development of the fire truck, both on and off the reservation. The specifications for the chain mesh and asbestos mat were worked out from equipment used by ranch operators in South Dakota. Similar equipment is being used by other Indian reservations in the Prairie States.

This type of equipment can be used only on areas that are relatively flat or rolling. The outfit has not been tried out on heavy sagebrush or shrub areas, but it is believed not to be practical for vegetation of such type. Its application is confined largely to areas of grassland and light shrubs in flat or rolling country. In general, the equipment can be used in areas which can be negotiated by a light truck.

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Truck rigged for action.

The chain mesh and asbestos mat drag is designed to accomplish two purposes: The chain mesh, the position of which is directly on top of the fuel, serves to break up the material and mix it to some extent with dry top soil; the asbestos mat, which is fastened over the chain mesh, shuts off oxygen from the burning material.

In areas of light to medium cover, one trip over the fire line is usually sufficient to extinguish the fire. Where the grass cover is heavy it may require more than one trip to extinguish the fire in the line made by the drags. However, the first trip usually deadens the fire to such an extent that it will not run for a considerable period of time. Mop-up crews are then used, if available; otherwise a second or third trip is made over the line with the truck. A certain amount of mop-up work is nearly always necessary to remove or extinguish the dry dung usually found in these areas. This may be done by spraying with water, burying, or tossing well within the burned line where it will burn out.

The original specifications for the chain mesh and asbestos mats are as follows:

1. The chain mesh shall be rectangular in shape, shall not be less than 80 by 100 inches and shall be constructed of round, welded rings made of 3-16-inch round steel stock, 1½ inches inside diameter. Every odd-numbered row of rings of the chain mesh shall form a complete chain having an odd number of rings. Every odd-numbered ring in each of these chains shall be connected with a single ring, forming the even-numbered rings of the mesh.

2. The asbestos mat shall be made of good-quality wire-inserted cloth weighing approximately 4 pounds per square yard, and shall be finished to 80 by 100 inches including all seams and hems, which shall be securely sewed and riveted. The manufacturer shall fasten the two mats together with heavy metal fasteners every 15 inches in rows 15 inches apart, and shall securely bind the chain mesh and mat together on all outside edges.

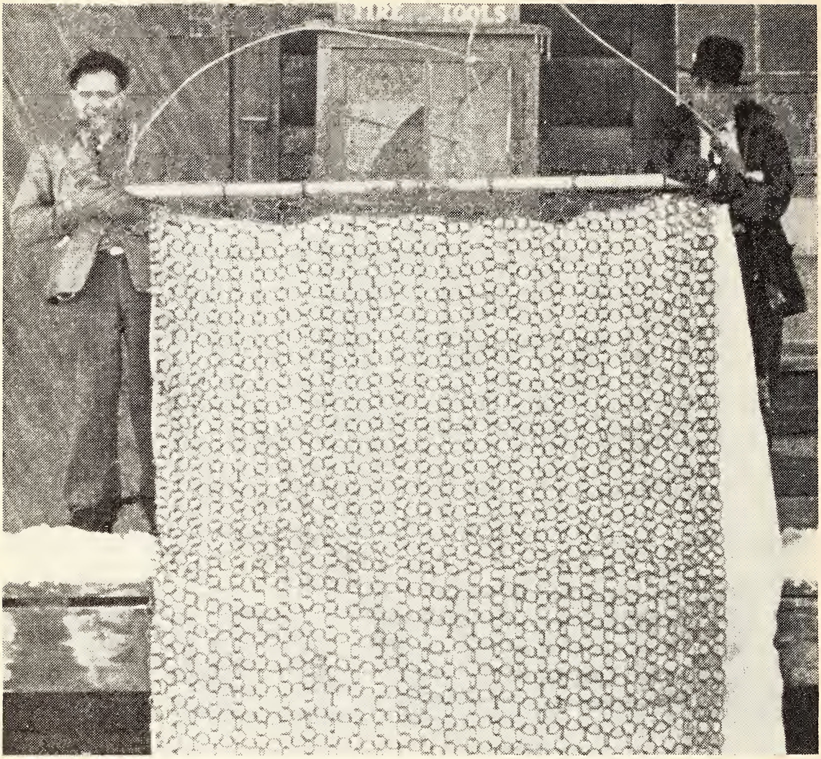
Since it is somewhat difficult to visualize the construction of the chain mesh, a detail drawing showing how the rings are put together is given in the following diagram. This diagram also gives the specifications for rigging the truck.

It will be noted that the over-all dimensions of the mats as given in the specifications differ somewhat from those given in the diagram. This difference is due largely to the fact that the mesh and mat measurements as given in the specifications, are made with the rings and asbestos stretched tight, while those in the diagram are after actual use, causing them to be loose and somewhat wrinkled.

The asbestos mats of very recent construction are equipped with snap fasteners, with which they are attached to the chain mesh instead of rivets.

The diagram and photographs give all construction features necessary to rig the truck. The mats should be attached on the driver's side so that he may watch them closely in order to prevent damage by running into obstacles and to see that they are functioning properly.

The front mat is attached to a pipe 3 inches in diameter and 10 feet long. This pipe is fastened to the heavy front bumper with steel plates welded to it and containing holes large enough to receive the pipe. A pin on either side of one of the plates is necessary to keep the pipe from slipping out. A pig-tail hook is fastened into the end of the pipe to receive the cable attached to the mat.


U. S. INDIAN SERVICE

Close-up of chain mesh and asbestos mat.

The rear pipe is set at an angle. The proper angle was determined by experimentation and may vary somewhat on other trucks. About 20° to 25° forward proved to be most satisfactory on the trucks used. The two steel plates and the method of attaching them are shown in the photographs. The left-side plate is relatively simple—a hole cut into it being large enough to accommodate the 3½-inch pipe—and is bolted to the chassis and body of the truck. The right-side plate has a band welded to it to keep the pipe from slipping through. This is all the fastening necessary to keep the rear pipe in place, as the drag of the mat keeps it from slipping forward and out. Both right and left turns can be made without difficulty.

Length of the cables which attach the mats to the projecting pipes is a matter of judgment. The shorter the cable, the steeper the angle will be between the pipe and the front of the mat. If the cable is too short there will be considerable loss of efficiency due to the mats lifting from the ground when the truck is in motion. For the front mat it has been found that the leading edge must be at least 28 inches from a perpendicular line extended from the end of the pipe to the ground. The distance on the rear mat must be somewhat greater since the pipe is much farther from the ground.

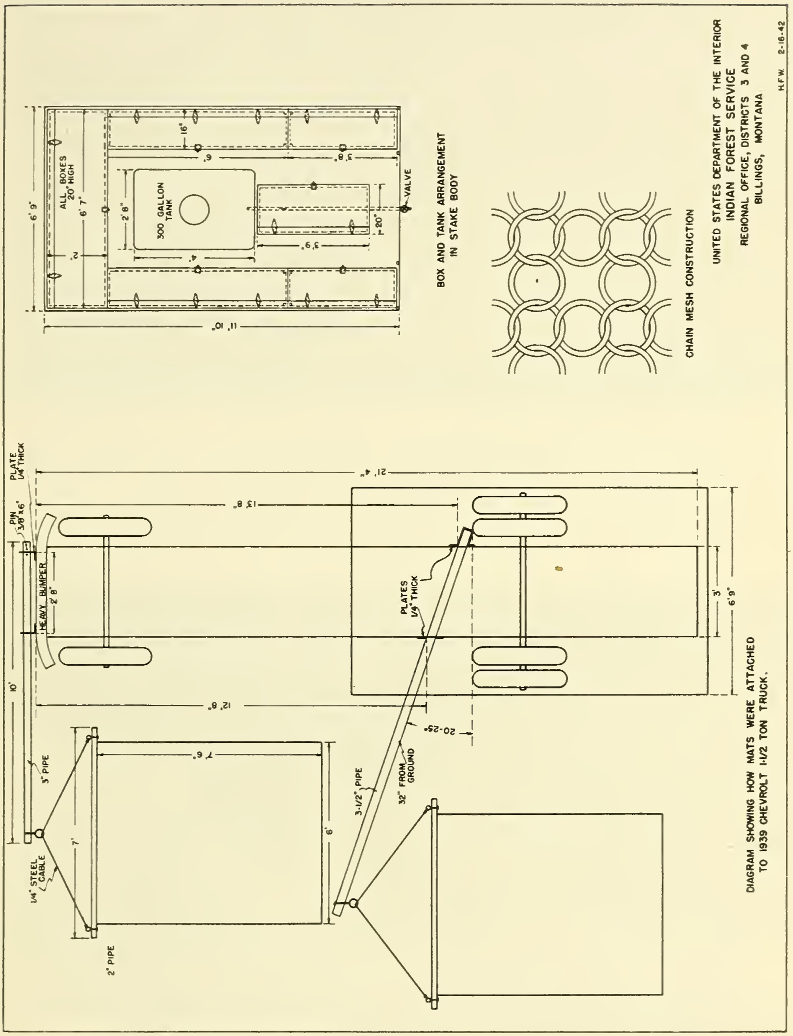


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Diagram for rigging truck.

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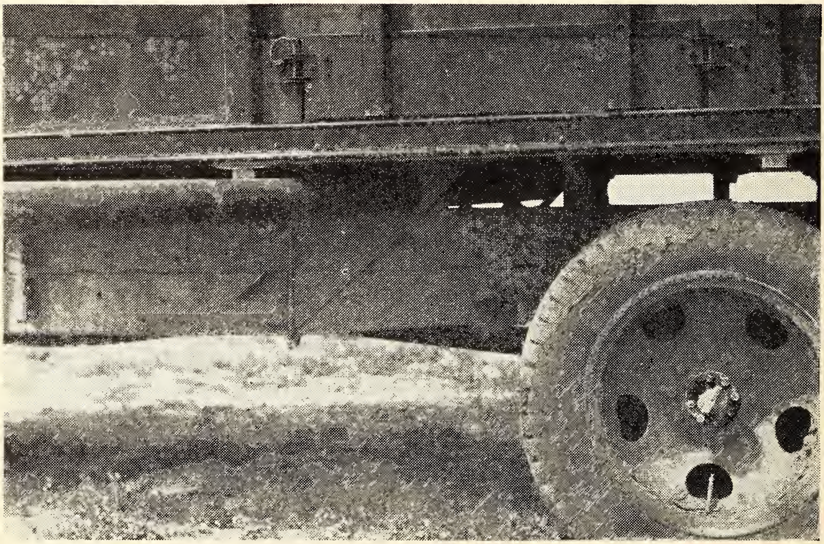
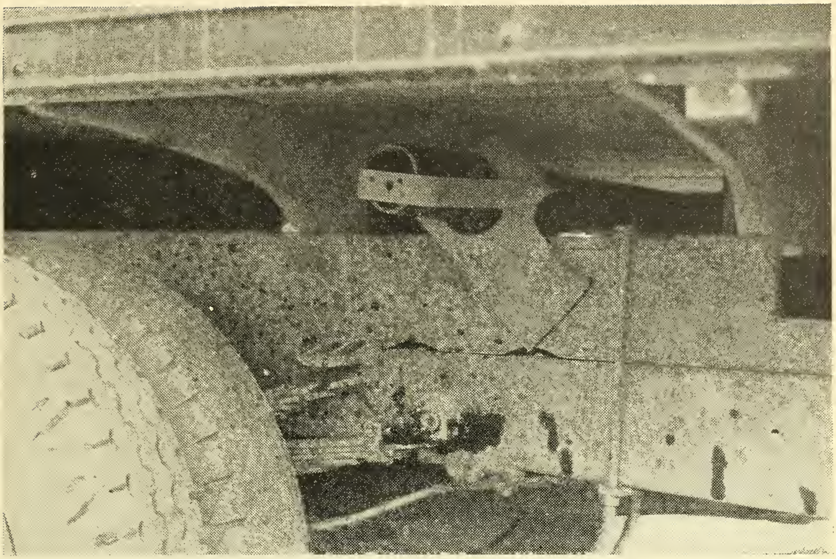
How the front assembly is attached.



U. S. INDIAN SERVICE

How left rear plate is attached.



U. S. INDIAN SERVICE

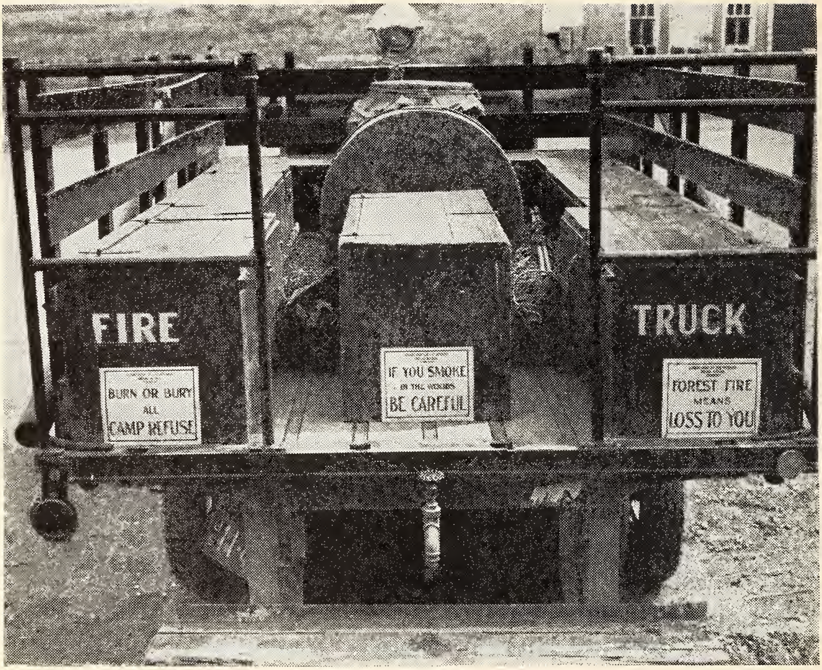
Right rear construction which keeps pipe from slipping through.

If the cables are too long there may be some difficulty in negotiating turns as the mats may be caught under the wheels of the truck. Experience has shown that there is a high proportionate loss of efficiency as the truck approaches a speed of 10 miles per hour. The arrangement on the truck causes the mats to lift from the ground at a speed of about 9 to 10 miles per hour. Best results are obtained at a speed of about 5 miles per hour, since this allows the drags to remain for a sufficient time over a given area to cool the burning material, gives the driver more time to maneuver the truck, and prevents serious damage if an obstacle is encountered.

The mats are usually dragged directly over the fire line, with the truck on the outside of the fire. However, if the ground cover is quite dry, and not too dense, a line may be dragged outside of the fire line with equally good results. A line is formed which is from 6 to 8 feet wide and is generally sufficient to stop a grass fire. Under very high wind conditions it may be necessary to drag several lines fairly close together. Occasionally it is necessary to backfire a small area which may be too rough to drive through but around which a line can be dragged. At other times a line of fire can be started with a torch, the truck being driven behind to extinguish the outside of the fire, allowing the inside to burn in toward the main front.

The truck is equipped with a large searchlight which is operated by a crew member for night work. It is useful to penetrate smoke and to allow the driver to plan his route as far in advance as possible.

The body of the truck is equipped with boxes and a tank, as shown in the diagram and photographed. The boxes were made of surfaced material a full inch in width. The hinged lids were made of heavy



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Tank and tool box arrangement in body of truck.

material about 1⅛ inches in thickness, since they are used as seats for the crew. The tank has a capacity of about 300 gallons and is provided with a valve at the rear of the truck for filling back pumps and water bags. The opening in the top of the tank is large enough to admit a bucket and is kept closed with a piece of canvas held in place by a band made from an inner tube. The water in the tank is changed every other day to provide fresh drinking water for the crews. On long runs a bucket of water is occasionally thrown on the mats by a crew member to cool the mats, as they become quite hot from friction with the ground and the fire.

The pipes to which the mats are fastened are carried on hooks attached to the outside of the stake body of the truck. The mats are rolled, with the pipe to which they are attached on the inside, and fastened with wire. They are carried between the tank and boxes in the truck. The truck driver has been able to assemble the mats in about two minutes without help. With help, the assembling takes less time. The loading of the mats on the truck can be accomplished by one man but is somewhat difficult.

The boxes contain equipment that can be used on both prairie and timber fires. Enough equipment is carried to outfit at least 25 men. A Pacific Marine pump and about 1,200 feet of linen hose, as well as other pump accessories, are carried in the box at the front of the truck body. Other equipment is as follows:

12 fire mops (swatters).
6 bags, water, canvas, 5-gallon man-pack.
6 pumps, hand-spray, with hoses and nozzles.
1 torch, propane, with backboard.
6 flashlights, headsets.
16 shovels, lady.
16 Pulaskis.
6 axes, d. b., 3½ pound.
1 saw, C. C., 5½-foot, with handles.
10 rations, emergency, one-man, one-day.
1 lantern, gasoline.
1 gasoline, high-test (gallon).
1 kit, medicine.
1 radio, SPF.
2 buckets, canvas, folding.
2 poles, antenna.
Files, stones, hammer, wedges.

The antenna poles are equipped with three rope guys and pegs so that they may be set up quickly at any place. Frequently the truck serves as one antenna pole. With two poles the radio may be set up independent of the truck. Otherwise the aerial is wrapped around the top of the stake body on the left side. The radio is carried in the cab, on the driver's seat, to cushion the jolting and prevent damage to it.

This truck is held in instant readiness for action at all times during the fire season. With the help of the truck nearly all grass fires on the Blackfeet Reservation during the past 3 years have been controlled by the "flying squad" which is loaded on the truck whenever there is a call. Under ideal conditions the truck can do the work of 50 men using hand tools.

EXPERIMENTS WITH FIBROUS WATER HOSE

(Continued from page 113)

tions. When the first man reaches the end of the first length he stops and inserts a sleeve in the second joint and continues to string out more hose. This process is continued until the desired point is reached. A little practice will enable the man stringing the hose to leave the proper amount of slack.

The second man places the sump bag and connects the hose. He regulates the flow of water to about 5 gallons per minute and follows through to the end of the first section. He straightens out bad kinks and may move the hose a foot or two for better location. He then connects the first and second joints and repeats the process. When the water reaches the desired point this man returns to the intake and gradually increases the flow of water to all that can be forced through the outlet of the sump bag. Two men should carry their own supply of hose and connections and string about 1½ miles per hour over ordinary mountain terrain.

HOW ABOUT THE ESPRIT de CORPS

E. F. Barry

Staff Assistant, Flathead National Forest, Region 1, U. S. Forest Service

This article, which relates to the method of attacking and suppressing the Honey Fire (1,092 acres, Kisatchie National Forest, Louisiana, 1938) should be read in connection with Mr. Headley's article in Fire Control Notes, vol. 3, No. 4, October 1939, pp. 40–41, Lessons from Larger Fires of 1938, under the heading "Honey Fire." Methods of attack on fires in various situations in this location have formed a controversial subject, and it is not surprising that Mr. Barry has raised some questions in this instance. Based upon all the facts now known it appears that the only method of controlling the Honey Fire at a smaller acreage would have been an immediate attack by the indirect method of backfiring. The direct attack made, failed. The action showed clearly the need for the special study in fire behavior made on this area, to supply detailed facts for training and improved action in connection with future fires. (See Fire Control Notes, vol. 5, No. 4, October 1941, pp. 161–178, An Analysis of the Honey Fire, by C. F. Olsen.)

On most fires in some regions an early direct attack can be expected to help toward the final suppression accomplishments. In this instance, where the fire in dry grass aided by the wind spread very rapidly, a direct attack by the studies crew with hand tools a few minutes ahead of the suppression crew would have been ineffective toward reducing the suppression job or the final area. Also, as is indicated in footnote 2 on the first page of Mr. Olsen's article, the studies crew upon arrival near the fire was confronted with two fences and a railroad track which prevented passage of their truck. Although Mr. Olsen's article may permit of the question as raised by Mr. Barry, it appears the discovery by the studies crew of the errors made in action methods on the Honey Fire is of greatest value and vital in future suppression work. The criticism offered by the studies personnel is wholly constructive, pointing out actual faults as they occurred, and was given only to guide our protection organizations to better accomplishment when they may be confronted again with similar fire problems. The supervisor had previously agreed that the members of the studies crew were relieved of any obligation to assist in fire suppression, it being recognized that their full attention should be given to the essential research duties on fires.

A reading of the article of C. F. Olsen, entitled "An Analysis of the Honey Fire," in the October 1941 issue of Fire Control Notes, brings to attention a situation hard to imagine. Of course, it is practically impossible for us at this remote location to visualize all the factors; nevertheless, after making generous allowances, I still experience an unpleasant jolt when I think of what happened.

There were two branches of the same department involved in the suppression of a fire, one interested in determining how the fire would behave on a bad burning day, the other charged specifically with the responsibility for stopping its spread.

The branch interested in behavior arrived at the Honey Fire first, 3 minutes after its origin according to the article. A four-man fire-behavior crew had been traveling on a paralleling highway about a mile behind a train that stopped to service a hot box. The train crew carelessly threw some burning waste into dry grass and the behavior crew happened along 3 minutes later. They found it "definitely too big for them to hold." (See footnote 2, of Mr. Olsen's article.)

The decision of the fire-behavior crew—equipped with a car having various fire-fighting tools—to refrain from an attempt to check or retard the spread of this fire when it was approximately 100 feet long is hard to understand. We would expect more from four untrained men off the street as a quality of citizenship. Forest Service guard-training instructions have emphasized for years that there is always something that even a single guard can do to retard the spread of a fire, although it may be obvious that a frontal attack is impossible. The failure to make some attempt in that direction on the part of this fire-behavior crew indicates that they did not believe in such a theory. Won't the morale and fighting spirit of our temporary guards be lessened by such an example? The public, too, may find such action, or lack thereof, confusing.

If the fire-behavior crew admitted that they were unskilled in fire fighting and limited their report to the factors of weather and rate of spread, their disregard for attempting control action could be overlooked to some extent.

The fact that suppression foremen, who apparently did their best to stop this fire, were subjected to criticism by such men indicates an oversight in personnel management that cannot help but decrease spirit and morale in a marked degree. Moreover, the fire-behavior crew has been permitted to make capital of their questionable action by printing the results of their study.

There is no quarrel with the policy of conducting fire-behavior studies, and the men assigned to that duty should not be expected to take part in the suppression work on fires that have escaped first control efforts. However, there should be no tolerance of a policy permitting an organized crew of men to travel about the country looking for fires to study unless they are willing to lend a hand in an effort to check the spread of small fires pending the arrival of regular suppression crews.

It is hoped that in the future this fact will be made clear to all, so that even though a fire cannot be entirely stopped, it may be retarded, thereby permitting arriving suppression crews to handle it more easily. That kind of action will make far better reading than the one referred to above, and the results after the fire is out will go far toward strengthening the spirit and morale of the whole organization.

REPAIRING LINEN FIRE HOSE

Anne C. Allen

Chief, Cedar Hill State Forest Fire Experiment Station, Cedar Hill Fire Department, Cowesett, R. I.

An easy and efficient method of repairing the leaks, or "weepers," in linen fire hose has long been the aim of many departments. All forest-fire-fighting organizations have had the experience of placing in use brand-new hose and finding holes that emit streams the size of a lead pencil. These holes, caused by the knotting of the thread during manufacture are annoying, to say the least. Furthermore, lengths of hose that have been in service for a time will spring serious leaks.

With an eye to saving hose for war needs, this station began intensive research into the matter of repairing hose. Finally evolved was a method for repairing that will work, not only on linen fire hose but

Plugs used in linen hose.

on regular rubber-lined fire-department hose. The method is easy and efficient, may be employed while the hose is in use, and is low in cost.

M. L. Holst, Chief Forester for the Cedar Hill Forest Fire Experiment Station, conducted the research and tests over a period of several months and under various conditions. It was found that the most inexperienced members of the Rhode Island State Forest Fire Service crews could, by using the method, make repairs on filled hose at 150 pounds pressure, or even higher.

Back in the "gay nineties" when bicycles were the rage, a small brass plug to stop air leaks in single tube bicycle tires was invented. There were several different makes, among them the Sampson brass plugs, patented April 1898, and the Spooner brass plugs. All bicycle stores carried the plugs then and they and the large mail-order houses still carry them. These small brass plugs have now been put to a new use—that of repairing the leaks in fire hose!

The plugs come in three sizes—large, medium, and small. The two larger sizes are best for repairing fire hose.

The efficiency and durability of the plugs could be greatly increased if they could be dipped in some sort of rubber solution, which would cover the bottom and cap with a coating of rubber. It has not been possible, however, to interest anyone in manufacturing a rubber-covered plug, because of present war conditions.

FIREBREAKS PREVENT LARGER FIRES

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In other words, during the past 2 years there has been a direct saving on the area of 464 acres of burned area, $340 of suppression costs, and $438 of estimated damage.

It is not expected that this firebreak is going to stop all the fires on the area, nor has it solved all of the fire problems, but so far no fires have crossed it.

The evidence is that thus far it has been a great help in limiting the size of fires, which has resulted in smaller suppression costs and less damage. Its value will be better appraised in the future.

WHERE ARE WE GOING WITH CONFLAGRATIONS?

LOWELL J. FARMER

District Ranger, Powell National Forest, Region 4, U. S. Forest Service

Looking ahead to new fire-control methods as one forest officer sees them.

It is the year 2042. Tremendous acreages of second-growth timber cover the areas that 100 years ago had scarcely known the ring of the woodsman's ax and saw. The summer is hot and dry, and every lookout is at his post, tense and waiting. An electric storm slowly darkens a vast panorama of forest land and the fireworks begin. Suddenly the headquarters radiophone booms out information on two smokes. Within 3 minutes two planes are following the radio beam to the fires. Approaching the rising smoke columns, they circle low, emitting dense billows of oxygen-eating gas that settle rapidly to the ground smothering the flames that are already getting under way. As the planes circle to return for a recharge of gas two more take their places. Two transports discharge small smoke-chasing crews by parachute and within a short time the fires are under control.

Combined research and experience in dealing with forest fires today (1942) is approaching the point where, in probably much less than 100 years conflagrations will be unknown. Developments in technique all point toward a methodical and precise handling of potentially large fires. Radio is used now in all the ways mentioned. There is every reason to believe that a direct beam to any point will be used in the future. The gas may be one we know or it may not yet have been developed.

The other angle is simply consideration of forest fires from the point of view that combustion is a chemical reaction, while we have not given suppression activities a strictly chemical approach.

Those who studied elementary chemistry learned that the requirements for combustion are:

1. Proper mixing of fuel and air in proportions which will insure complete combustion.

2. Exposure of fuel particles to oxygen throughout a period of time sufficient for their combustion.

3. Maintenance of the combustion zone at a temperature above that of the ignition zone.

Fire-danger rating charts now in wide use successfully forecast the first requirement, and we prevent the other two by removing the fuel. As far as I know, we have never attempted to handle a potentially large fire by removing the oxygen supply. Will this be the next experimental step in suppression technique?

Theoretically, as determined from a table on the combustion properties of fuels, 11.5 pounds of air are required to burn 1 pound of car-

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LIGHTNING VERSUS BOMBS

L. L. Colvill

Assistant Forest Supervisor, Siskiyou National Forest, Region 6, U. S. Forest Service

On July 13, 1941, at 10 p. m., the Bear Basin Lookout house, elevation 5,300 feet, was struck by lightning and the same strike started the Bear Basin fire.

District Ranger Quackenbush and the writer investigated the results of this strike the next day, and the following is a brief description of what we found.

The look-out building is a gabled-roof, 14 by 14 Alladin house, equipped with standard lightning protection, and with the ends facing north and south.

Apparently the lightning bolt was horizontal and struck the north end of the building at the top of the window sash and in the approximate center, and appeared to have exploded when it contacted the lightning conductor which extends across the end of the building at the top of the window frame. This end of the building was blackened for several feet in all directions. A considerable portion of the charge was carried from the building by the northwest guy line, as evidenced by the ground which was torn up for several feet where the line was anchored. At practically every point where the lightning conductor was fastened to the building, there were indications of a heavy voltage. The impact against the building was so great that it shattered one window sash, and approximately two-thirds of the window panes in the building. Much of the broken glass was pulverized and there was hardly a piece bigger than a dime. The nails in the building at the north corners were so loosened that many of them could be pulled by hand. A radio antenna wire, which extended for about 50 feet on the north side of the building and which was disconnected before the storm and left lying on top of the brush, was completely burned and the brush was scorched.

A considerable portion of the charge went through the building directly over the fire finder, striking a gasoline lantern which hung from the ceiling and shattering the globe but leaving the mantels untouched, then passed out through the window at the opposite end of the building, resulting in two holes in the top panes approximately 5 inches in diameter. The look-out and his wife were standing on opposite sides of the fire finder, and this portion of the charge going between them and slightly over their heads knocked them unconscious for approximately 1 hour.

The master switch for protection of the telephone was located on a pole approximately 10 feet from the south end of the building and directly in the line of travel of the lightning. It was struck at the point where the copper U-connectors holding the ground rod are fastened to the box. The charge was further broken at this point, and a portion went through the discharge gap in the switch with such

force that it broke the bakelite base and went out over the telephone line, eliminating all traces of the line for one-fourth mile. A part of the charge was deflected down the copper ground conductor to where it connected with the No. 9 galvanized telephone ground line. This telephone ground was anchored in a spring approximately one-fourth mile distance, and the lightning eliminated all traces of this ground line for approximately 400 feet and set the brush on fire for this distance. The telephone was not damaged. No doubt the lightning conductors carried away a large volume of the charge, but the fact that the building failed to catch on fire and cremate the unconscious bodies of the look-out and his wife is miraculous.

Thirteen days later lightning again struck at Bear Basin, but this time its course was more conventional. The lightning struck a tree located several hundred feet from the building, on which the telephone line was anchored, followed the telephone line through the master switch which had not been opened, burned out the lightning protection fuse, and entered the telephone instrument and burned out the generator, thus completing the job started July 13.

WHERE ARE WE GOING WITH CONFLAGRATIONS?

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bon. Mr. Fredrick T. Morse, assistant professor of mechanical engineering at the University of Virginia, has devised the following formula to determine the number of pounds of air necessary to burn 1 pound of coal:

$$\text{Air}=11.5C+34.5\ (H-\frac{8}{0}+4.35S)$$

Substituting in the formula where the symbols represent fractional portions of the elements, it should be a simple matter to determine the amount of air necessary to burn any of the forest fuel types. The reducing action might then be accomplished by any gas having sufficient weight and density to adhere to the ground level and possessing the ability to absorb enough oxygen to bring the available amount below that required. The factors of atmospheric density, pressure, temperature, and motion would all enter into the computations.

At the end of this year we will read quotations on the thousands of acres of timberlands destroyed by fire. Next year the figures will be compared with those of previous years and remarks will be cast about peak years and good years. New forest-fire films will be made. The public educational program will be expanded. New features such as "hula dancers" and "fag bags" will catch the public fancy and make them fire conscious. But we still summarize our annual fire losses in *thousands* of acres. The fag bag has served its purpose when it prevents a fire, but there will always be lightning storms and there are too many fires that get out of bounds before men can be placed on them. Let's not wait until 2042. Conflagrations can be licked and some day someone is going to figure out a way to do it.

CEMENT AS A FIRE EXTINGUISHER

Roy Cross

Kansas City Testing Laboratory

SCIENCE, January 23, 1942, contains a short article "Pitch the Best Incendiary Extinguisher," by Dr. R. R. Sayres, Director of the U. S. Bureau of Mines.

It would seem to the writer that a good deal of caution should be used in the application of pitch to extinguish fire, even though it originates from a magnesium incendiary bomb. It has been the experience of the writer with a great variety of small fires in oil, metals, and other materials, that there is nothing so satisfactory and so foolproof as portland cement as it is placed on the market. In many cases in the writer's experience it has been highly successful in extinguishing fires where water, carbon tetrachloride, foam, and similar substances have been unsuccessful. This very common material so easily available and so safe to use should be placed at points where there is danger from fires either from incendiary bombs or from normal causes.

In our own laboratory, such material is easily available in kegs and we find it far more successful than the usual fire extinguishers. Furthermore, it gives off no injurious gases and is in itself not combustible, as is the case with pitch.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Legends for illustrations should be typed on a strip of paper attached to illustrations with rubber cement. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing illustrations, place between cardboards held together with rubber bands. Paper clips should never be used.

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustration. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired. Do not submit copyrighted pictures, or photographs from commercial photographers on which a credit line is required.

India ink line drawings will reproduce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.

The approximate position that illustrations bear to the printed text should be indicated in the manuscript. This position is usually following the first reference to the illustration.

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